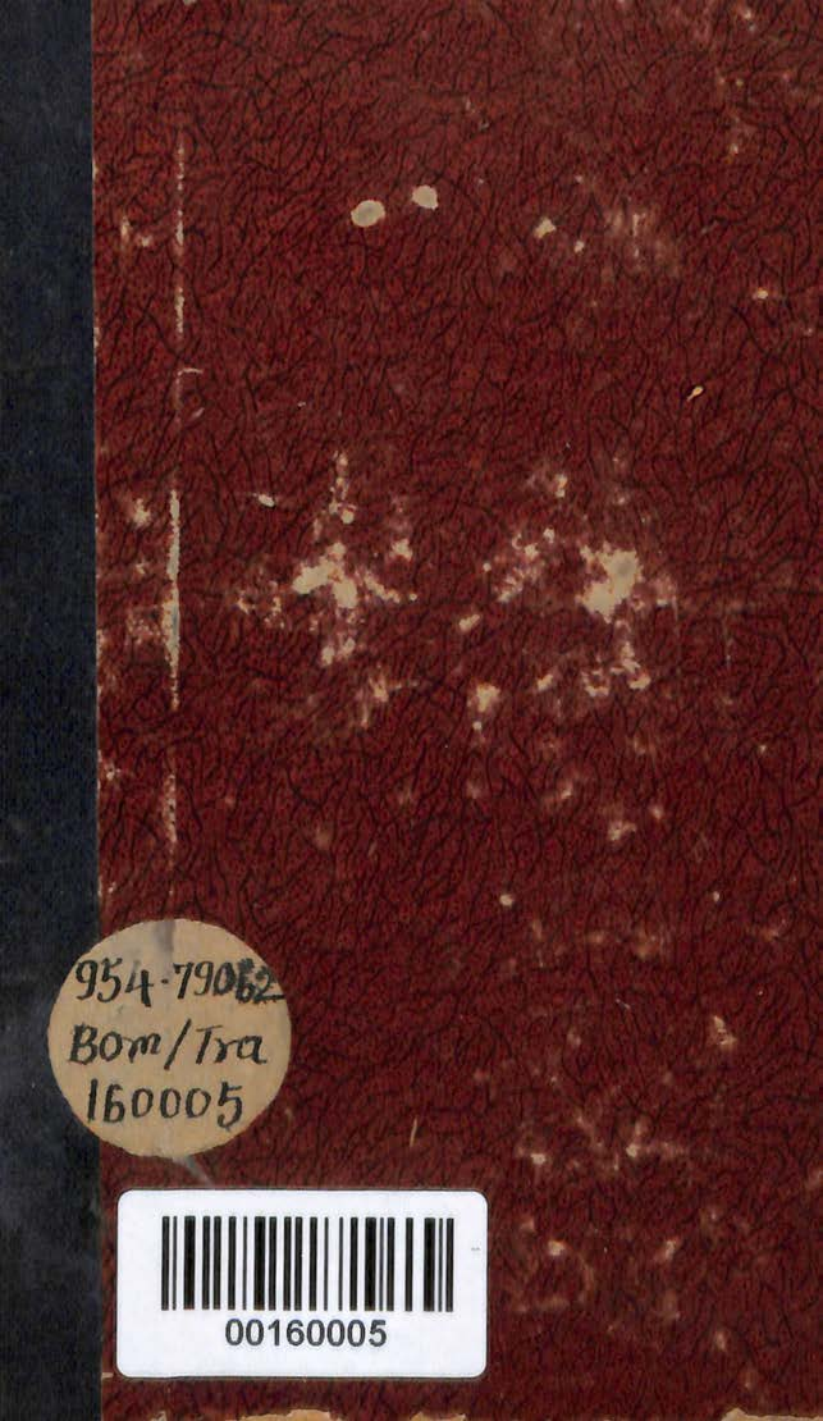
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THE

TRANSACTIONS

OF THE

BOMBAY GEOGRAPHICAL SOCIETY.

FROM MARCH 1856 TO MARCH 1857.

(NEW ISSUE.)

EDITED BY THE SECRETARY.

VOLUME XIII.

BOMBAY
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TRANSACTIONS

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BOMBAY GEOGRAPHICAL SOCIETY.

ART. I.—*Notes on the Lotus, or Sacred Bean of India.* By DR. GEORGE BUIST.

HAVING for some time resided in the neighbourhood of a number of considerable ponds in Bombay, containing large multitudes of water plants, amongst which the Lotus and the Water Lily held conspicuous places, I from time to time noted some of the most conspicuous peculiarities regarding them that presented themselves, and the following results, which lay no claim to anything deserving the name of Science, may, I have some reason to believe, be found to supply a number of facts not hitherto laid before the world.

The Lotus itself is one of the most elegant of eastern flowers, and seems from time immemorial to have been, in native estimation, the type of the beautiful.*

* *Lotus*, the Water-lily.—This plant is held sacred throughout the East, and the deities of the various sects in that quarter of the world are almost invariably represented as either decorated with its flowers, seated or standing on a lotus throne or pedestal, or holding a sceptre formed from its flower, sometimes expanded, and at others closed. These flowers are said to be found in some parts of India blue, and in the southern parts white or red. It is fabled that they obtained the last-mentioned colour by being dyed with the blood of Siva, when Kamadeva wounded him with the love-shaft arrow, as related under the articles Siva and Kamadeva. Lakshmi is called the Lotus-born, from having ascended from the ocean on its flower in the Kurmavatara. Its expanding and closing powers, and its beautifully brilliant colours, afford an infinite variety of metaphors to the Hindu poets. Thus the lotus is with them as the lovely varying rose among the Persians. The lotus floating on the water is the emblem of the world. It is also the type of the mountain Meru, the residence of the gods (see *Meru*, p. 253), and the emblem of female beauty. No wonder therefore it is the poetic flower of the Hindus.—*Coleman's Mythology of the Hindus.*

The Lotus flower is repeated *ad infinitum* in the earliest Eastern sculptures as that on which Bhuddah sat, and from which Bramah sprung. In the Cave Temples of Salsette, dating back several centuries before the Christian era, it is represented everywhere as an emblem at once and an ornament.

The following is from Professor Lindley's work on "The Vegetable Kingdom" :—

Nolumbiaceæ. Ed. Pr. Wight. *Illust.* i., S. 9.

Diagnosis Nymphal Exogens, with distinct Carpels immersed in a taze; honey-combed torus, and without Albumen.—*Lindley.* Nelumbrum spendean.

"Herbs, with pelate, fleshy, floating leaves arising from a prostrate trunk, growing in quiet waters. [The rhizome growing at the point, with bundles of vessels forming a net-like cylinder, from whose outer and inner part bundles pass to the leaves and lateral flowers.—*Unger.*] Sepals 4 or 5. Petals numerous, oblong, in many rows arising from without the base of the torus. Stamens numerous, arising from within the petals, in several rows; filaments petaloid; anthers adnate, bursting inwards by a double longitudinal cleft. Torus fleshy, (Pl III. Fig 9) elevated, excessively enlarged, inclosing in hollows, of its substance the carpels, which are numerous, one-seeded, with a very short style and simple stigma.

2 1 Fig. CCXC.

Ovule single, suspended from the point of a cord rising from the base of the cavity, anatropal. Nuts numerous, half buried in the hollows of the torus, in which they are, finally, loose. Seeds solitary, rarely 2; albumen none; embryo large, with two fleshy cotyledons and a highly developed plumule, inclosed in its proper membrane.

Fig. CCXC.—Nelumbium speciosum. 1. a section of its young carpel; 2. a section of the same when ripened into a bean, and showing the structure of the seed.

"This beautiful race of water plants offer some of the most striking exceptions to the usual importance of albumen as a general mark of affinity; for, although undoubtedly a member of the Nymphal Alliance, it has not a trace of albumen. Its cotyledons, however, are crammed with starch, and it has a plumule so completely organised, that it is ready to perform all the functions of growth the instant that germination is excited, and thus that necessity for a separate magazine of food, which is so great with the feeble Nymphæaceous embryo, does not here exist. The nature of what is here called the proper membrane of the plumule is not explained by Botanists. Richard regarded it as a cotyledon, the apparent cotyledons being in his view a two-lobed radicle. Ad. Brongniart refers it to the sac of the amnios, which seems inadmissible. De Candolle regarded it as a stipule; but it is found in connection only with the first leaf of the plumule, while, if De Candolle is right, it ought to be present at the base of the second leaf also. The singular enlargement of the torus, which constitutes so striking a feature in these plants, is probably a less important circumstance than their large exalbuminous embryo (Pl. IV).

Natives of stagnant or quiet waters in the temperate and tropical regions of the northern hemisphere, both in the Old and the New World; most abundant in the East Indies. They were formerly common in Egypt, but are now extinct in that country, according to Delile.

Chiefly remarkable for the beauty of the flowers. The fruit of Nelumbium speciosum is believed to have been the Egyptian Bean of Pythagoras, and the flower that Mythic Lotus, which so often occurs on the monuments of Egypt and India. The nuts of all the species are eatable and wholesome. The root, or more properly the creeping stem, is used as food in China (Pl. IV). Dr. Roxburgh relates that the tender shoots of the roots (rootstock), between the joints, are eaten by the natives of India, either simply boiled or in their curries. The seeds are eaten raw, roasted, or boiled.* Nuttall states that the tubers of Nelumbium luteum resemble those of the Sweet Potato, are as farinaceous and agreeable when boiled, and are used for food by the American Indians. Endlicher says that the milky viscid juice of the leaf stalks and flower-stalks is employed as a remedy against sickness and diarrhœa, and that the petals, which smell of Anise flowers, are slightly astringent and used like Rose flowers. Dr. Wight informs us that the leaf and flower-stalks abound in spiral vessels, which are carefully extracted in India and formed into those wicks 'which on great and solemn occasions are burnt in the lamps of the Hindoos placed before the shrines of their gods.' Similar wicks are prepared from some Nymphæas, but are not considered so sacred.*

GENUS. Nelumbium, *Juss.* *Nelumbo*, Gærtn. *Cyamus*, Salisb.
NUMBERS. GEN. 1. Sp. 3, at least.
POSITION.—Nymphæaceæ.—NELUMBIACEÆ.—Cabombaceæ."

The only variety of Lotus of which I can from personal observation speak is the pale rose coloured, the flowers of which in their natural state, full blown but not extended, frequently form a globe of from 6 to 7 inches through. The leaf is from 14 to 16 inches in diameter, the leaf and flower stalks about

* I presume the wicks are formed from the dried flower or leaf-stalk. I do not believe that all the spirals of all the Lotuses of India, from the Himalayas to the Line, would make a lamp wick a yard long the thickness of the finger. Individually the spirals are finer than gossamer.—G. BENT.

1½ inches in girth at their thickest, and from 6 to 8 feet in length according to the depth of the water in which they grow: they seldom rise higher than from 2 to 2½ above the surface, but elongate themselves to this extent even when the water is at its deepest.

The Lotus leaves begin to shew themselves early in March, mostly around the margins of nearly dried up tanks, pools, and lakes. The stalk of the leaf is at first, seldom more than a few inches in length. The root runs along in long white stems about the thickness of the little finger, throwing out dark brown bunches of rootlets from 3 to 4 inches long every two or three feet (Pl. I. Fig. 1). These anchor themselves firmly into the ground near the surface till the water is reached. The root stem then sweeps along, floating near the surface for many yards at a stretch, throwing off double branches at each joint, and so speedily covering the whole extent of the lake. Every joint gives off three new shoots: one forms a leaf, and two go on to the right and left, doubling once more at the next rooting place. The stalk is full of air and very buoyant;—so soon as the plant desires to anchor itself once more in the ground, it sends off a heavy dense shoot, which on reaching the bottom gives off rootlets which, when fairly fixed, allow the stem of the leaf or flower to re-ascend. It is only from those joints which have fastened themselves firmly to the ground, that leaves rising above the water, and not depending on floatage for stability, or flowers, are thrown off. At first the leaves float upon the water; and two-thirds of them at least so continue, forming an uniform bright green covering over the surface, completely hiding all beneath; a third or fourth rise up on stalks from 18 to 24 inches above the surface, the height to which the flower-stalks themselves ascend. A tank covered with Lotuses, in flower presents a spectacle of the most singular beauty. The leaf has the power of throwing off the little ripple raised by the water; this shews in the hollow of the leaves like gigantic drops of dew or masses of pearl. The leaf is buoyant enough to support a crow, and is frequently made use of by that bird as a fishing station, from which flies, snails or water lizards are preyed upon. The natives use them continually in place of plates or dishes, from which they eat their food (Pl. II. Fig 4).

The flower has something of the smell of the Tonquin bean, or of the common bean blossom.

The Internal structure of the Root, Flower, and Leaf Stems is nearly the same in all, with this difference—that the former two have mostly 7 or 9 large air tubes, as figured in the diagram, and 15 or 20 small ones. The leaf-stalk has four large air tubes, of which one pair is much wider than the other, and eight or ten small ones. The root when sliced across is nearly white—the leaf and flower stems palish green, beautifully freckled with points of darker

green or greenish brown. Externally both sets of stems are covered over with a thick skin, abounding in hairy prickles.

SECTIONS. NATURAL SIZE.

Of Root.

Of Flower Stalk.

Of Leaf Stalk.

The air tubes extend along the whole length of the stem from the root to the leaf or flower, or from one joint of the root to another, with certain striking distinctions by and bye to be described. Where the root occurs they terminate suddenly, the whole mass for a couple of inches or so being occupied by an interlacement of woody fibres, with intervals between, which are filled up with a congeries of minute cells filled with particles of starch.

The dark brown feathery fibres of the roots are frequently from one to four or five inches in length (Pl. I. Fig. 1).

When the stalk is cut across, a copious efflux of a milky fluid makes its appearance, apparently from the ruptured cells, and continues to flow for some seconds. If the stalk be broken, and not cut, and the separated portions drawn gently away from each other, a set of beautiful transparent films, thirty or forty in number, like the fine spun threads of a spider's web, make their appearance, and may be extended for 6 or 8 inches without breaking. A pocket magnifier will shew these to be spirals—under a glass of moderate power, they are developed into beautiful coils of blonde-ribbon-looking tissue (Pl. IV). The spirals seem to occupy a series of lacteals or milch tubes filled with milk, and when drawn carefully out, little globules of this adhere to them. They appear to wind round and line the interior of these tubes like a ribbon. Spirals abound in every part of the plant: the roots and stems are full of them, and scarcely any portion of the leaf can be torn, in which they do not make their appearance in profusion. They seem nearly all of the same size, form, and structure.

The large tubes themselves never contain water, or any visible fluid, but are at all times filled from end to end with air. All the tubes are cut across by thin septa, at intervals of from five to six inches, no two tubes ever being so interrupted at the same place. The septa are formed of a rich network, the spaces being triangular—a small swelling is observed at each junction point of the netting, the spaces between which are occupied by a thin transparent, apparently water-tight membrane, which the slightest pressure is sufficient to burst. The diaphragm is supported apparently by a series of

beautiful transparent finger-like papillæ, protruding to various distances from the wall of the tube. These nettings probably form a sort of lung or gill, and along with the spirals assist in the functions of respiration. They seem in the full grown stems at intervals of three or four inches—in the young and less mature stems, at the tenth or twelfth part of this distance. They appear to be developed at the earlier stages of the existence of the plant—their number remaining the same, but the intervals betwixt them increasing as the stems extend.

The flower of the Lotus closely resembles in form, that of the large-sized peony rose, only it is considerably bigger; the petals are all lancet shaped at the points (Pl. III. Fig. 5, representing a half expanded bud).

The leaves are pelate and suborbicular (Fig. 4): on their first protrusion from the stem they appear rolled up from both edges towards the centre, and so continue till they have quite reached the surface of the water, to which they advance angular wise, after which they at once unroll themselves (Pl. I). They are then generally from 3 to 6 inches in diameter; they afterwards spread out to ten or fifteen. The lower surface is of a reddish brown, covered with small spurs slightly fleshy and closely adhering to the water. The arrangement of the ribs of the leaf presents a singular and very beautiful appearance, peculiarly conspicuous from the lower side, though manifest throughout on the upper one. The portion exposed below by the folding is marked with a continuously elongated oval ring;—two pairs of the ribs, one pair on each side of the shorter diameter, spreading out as they extend from the centre, and drawing to a point at the circumference (Pl II). The upper surface of the leaf is of a deep green, to the eye it seems smooth, but is dull and lustreless. It repels the water when pressed under it, and when held obliquely, the light is reflected as if from a mirror.* The same thing occurs with drops or pools of water thrown upon it, and this peculiarity can only be overcome by rubbing the leaf, so as to destroy the fine texture, by which the result is brought about. This seems to consist in a coating of

*I have received the following note on the subject from my learned and much valued friend, the Reverend J. M. Mitchell:—

Dryaneshwari, Chap. III, Stanza 71.

तो कामना मात्रे न वेपे मोहमळे न लिंपे
जैसे जळी जले न शिंपे पद्म पत्र ॥

He is not enslaved by any lust whatever;
By the stain of passion he is not soiled,—
As in the water, yet unwet by the water,
Is the Lotus leaf.

minute button topped papillæ, by which a thin film of air is kept entangled, the water in reality never coming in contact with the actual surface of the leaf at all—a fact established and illustrated by its reflecting light from its own under-surface.

Repulsion of Water from the Leaves.—This phenomenon, with the Lotus more particularly, is one of common occurrence, though it has in general been very differently explained. It is beautifully manifested by the little *Pistia*, a water plant abounding in the shallower of our tanks, and resembling in appearance the common *Endevie*. This plant, which either roots itself on the margin or floats about on the surface of the water, has both sides of its leaves covered with a fine fur of silvery hair like papillæ, which when magnified shew themselves in the form of a succession of beads diminishing in size towards the apex;—they entangle and retain the air, and so obtain a high degree of buoyancy. When pressed under water they look like little flowrets of leaf or of frosted silver. It is the same organization that enables rose, clover, and young cabbage leaves, young shoots of grain and grass, and the numberless other plants that exhibit dew in its beautiful pearly form, and not as a little unreflecting pool, to repel water from their surfaces: the same that produces like results usually ascribed to oil or grease on the feathers of birds, especially of water fowl, and most of all of divers—which when they plunge under the surface seem to carry with them a perfect flash of light. A piece of glass, a varnished or greased surface or polished stone, throws the water off as perfectly as the various matters enumerated; but in none of these latter cases is there any appearance of reflection. The water, for the time being, is in perfect contact with the surface which throws it off—without being wetted—where there is no intervening air plate, essential to secure reflection. I have not before observed any such explanation, as has been here attempted, offered for this very beautiful class of phenomena;—it seems to me perfectly conclusive as well as new.

Respiration of the Lotus.—I know no plant in which the phenomena of respiration are so extremely conspicuous as in the Lotus, and without making any attempt at explanation, I shall endeavour to describe what I have observed: it must be kept in view that my observations are confined to what I have witnessed in a vivarium of very moderate dimensions, with sickly plants imperfectly rooted, and whose functions must have been languid compared with what they would have been in an open pool with the plant in full vigour and vitality.

On watching a little pool of water, on the Lotus leaf thin films of air will be seen leisurely to arise—at first barely swelling above the surface of the leaf itself to which they seem to adhere with some tenacity. The water flowing

over them, by the reflecting light from its under surface, shews the area over which the air is emanating, the form it is assuming as it grows in voluine, when increasing in depth from the crest down till it becomes detached in the shape of bubbles, disengage themselves, and rising to the surface. From 15 to 30 seconds is usually occupied in this, and the bubbles rise promiscuously, commonly at intervals of two or three inches from each other over the whole surface of the leaf. I have endeavoured to ascertain whether there be any particular circumstances or specific time when respiration goes on with greater or less activity, but have been unable to arrive at any trustworthy conclusion on the subject : —it *seemed* more active about two hours after sunrise —least so in the evening. I have not managed to collect the air respired from the surface of the leaf, but have obtained it in abundance from the leaf-stalks freshly cut across. From this it rushes out for days on end in a continuous succession of bubbles, which obviously come from the larger air-vessels, and are in volume proportioned to the size of the apertures from which they emanate. These air vessels, as already observed, have no direct visible communication with the water or atmosphere anywhere : they are cut across half a dozen of times at least by septa, and are entirely closed up at the root joints. Yet the vast volume of air discharged by them must either have been extricated directly from the water, or be the produce of the respiration which I have supposed possible through the lower portion of the leaf.

The phenomenon is peculiarly manifest where the leaf continues healthy and strong, while some one or more of the air vessels have become eaten through by the little water snails (*Pauladinæ*), which browse on them with such avidity. In this case it continues rising for hours in a continuous rush of bubbles. These proceed from the larger vessels alone, all of which on reaching the leaf pass on to a complex air chamber in its upper surface, from which numberless vessels are seen to extend themselves in all directions through the leaf. These doubtless afford those air bubbles, to be seen in such abundance when the leaf is itself submerged under or covered with water. Just within the outer coating of the leaf stalk are systyms of vessels, around the inner circuit the stalk filled with milk, and each provided with a spiral. As the lower side of the leaf is neared, a portion of these expand themselves into air tubes, and in this fashion enter the ribs of the leaf—a portion of them enter, but do not alter or expand, apparently feeding the leaf with milk. This is to be met with in abundance wherever it is cut, especially so, near the centre. Each rib contains two large air ducts or channels, affording a triangular section, as represented in the diagram (Fig 11). They contain air only, of what description I am not aware. However often the main ribs branch off, the double channel is maintained both in the principal and secondary, and in both

are, from time to time, cut across by partitions or septa, the nature and mechanism of which I have not yet ascertained. These air chambers are like the large tubes, the stalk, inlined here and there with papillæ, presenting to the uninitiated eye the appearance of hairs (Fig. 12 & 13).

Unfortunately I have neither had time enough nor a glass of sufficient power at my disposal to come to any satisfactory conclusions as to the more minute portions of the anatomy of the leaf.

I offer the following with the greatest hesitation, and as pure conjectures, the facts ascertained being comparatively few—many of them assumed as such still requiring to be established.

It is beyond doubt that all the larger tubes in the root and stalks are air vessels only, and conduce mainly, if not exclusively, to the functions of floatage or respiration. A single stem of one-third of an inch in diameter, containing air vessels of a sectional area of not more than one-fourth of this,—or say—two-tenths of an inch square, even where the leaf is cut off, and the natural energy of exhalation fails, have been ascertained by experiment to discharge 33 cubic inches of air hourly—the velocity with which the column advances must be at the rate of 20 feet an hour. This, considering the mass of the plant, is equal to the entire aerial circulation of many of our warm, blooded animals : and the Lotus must needs have been warm were the decomposition of the oxigen in circulation to obtain, which takes place under the ordinary economy of respiration. This much is fact: what follows is question or conjecture.

The air thus projected upwards to all appearance circulates in the upper surface of the leaf, and is in whole or in part thrown off. What is the function of the 38 large air vessels in the principal ribs &c., connected with the lacteals, having no visible connection with the larger air vessels ? Do they send air forward also ; and if so, whence is it derived ? The lacteals, which expand at their base, to all appearance contain no free gaseous matter whatever —are they respirants drawing vital air either from the water on which they float, or re conveying the defected portion of that which makes its way through the large tubes through the upper surface, and thus oxigemsing the lacteals which feed the plant ?

The hypothesis seems not without plausibility : it is hazarded to challenge an enquiry of very great interest, which want of leisure permits me not to pursue.

The whole plant seems as remarkable for the beauty and richness of its internal structure as it is for that of its external hue and form.

The following is from *Forbes' Oriental Memoirs*, Vol. III, p. 286 and 362 :—

"I do not know whether the seed of the lotos is eaten, or put to any other use in India, nor can I ascertain the variety of these plants in different parts. Eustathius says there are many kinds of lotos : he thinks Homer speaks of it as an herb, for he calls it ἄνθινον εἶδαρ ; and adds, that there is an Egyptian lotos, which Herodotus affirms grows abundantly in the Nile, resembling a lily ; the Egyptians take out the pulp or seed, dry it in the sun, and bake it as bread: this I think cannot be any of the class in Hindostan. Athenæus, in his Deipnosophist, quotes a description of the Lybian lotos, from Polybius, which was used as food by the natives ; but that also differs very much from the lily of the Nile, or the nymphea of Hindostan. Did any of the harmless Hindoos eat the seed or fruit of this plant, as they convert its leaves into dishes and plates at their own vegetable meals, they would exactly answer Homer's description of the innocent lotophagi.

' At length we touch'd, by storms and tempests tost,
' The land of *Lotos*, and flowery coast ;
' We climb'd the beach, and springs of water found,
' Then spread our frugal banquet on the ground :
' The people there are kind to foreign guest,
' They eat, they drink, and nature gives the feast ;
' The trees around them all their food produce,
' Lotos the name ; divine nectareous juice !
' (Thence call'd lotophagi) which whoso tastes,
' Insatiate riots in the sweet repast.' " ODYSSEY.—*Vol. III, p.* 286.

"I have often mentioned this lovely flower ; the intelligent Mr. Knight throws a new light upon the subject : 'growing in the water, amongst its broad leaves it puts forth a flower, in the centre of which is formed the seed-vessel, shaped like a bell, or inverted cone, and punctuated on the top with little cavities, or cells, in which the seeds grow to maturity, decay, and again shoot forth ; for the orifices of these cells being too small to let the seeds drop out when ripe, new plants germinate in the places where they were formed, the bulb of the vessel serving as a matrice to nourish them until they acquire such a degree of magnitude as to burst it open and release themselves ; after which, like other aquatic weeds, they take root wherever the current deposits them. This plant, therefore, being thus productive of itself, and vegetating from its own matrice without being fostered in the earth, was naturally adopted as the symbol of the productive power of the Deity upon the waters.' To this Maurice alludes in his beautiful poem on the lotos of Egypt.

' Within thy fair corolla's full-blown bell
Long since th' immortals fix'd their fond abode ;
There day's bright source, Osiris, lov'd to dwell,
While by his side enamour'd Isis glow'd.

What mystic treasures in thy form conceal'd,
Perpetual transport to the sage supply ;
Where Nature, in her deep designs reveal'd,
Awes wondering man, and charms th' exploring eye.

In thy prolific vase, and fertile seeds,
Are trac'd her grand regenerative powers ;
Life, springing warm, from loath'd putrescence breeds,
And lovelier germs shoot forth, and lovelier flowers.' "—*Vol. III, p.* 362

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1
2
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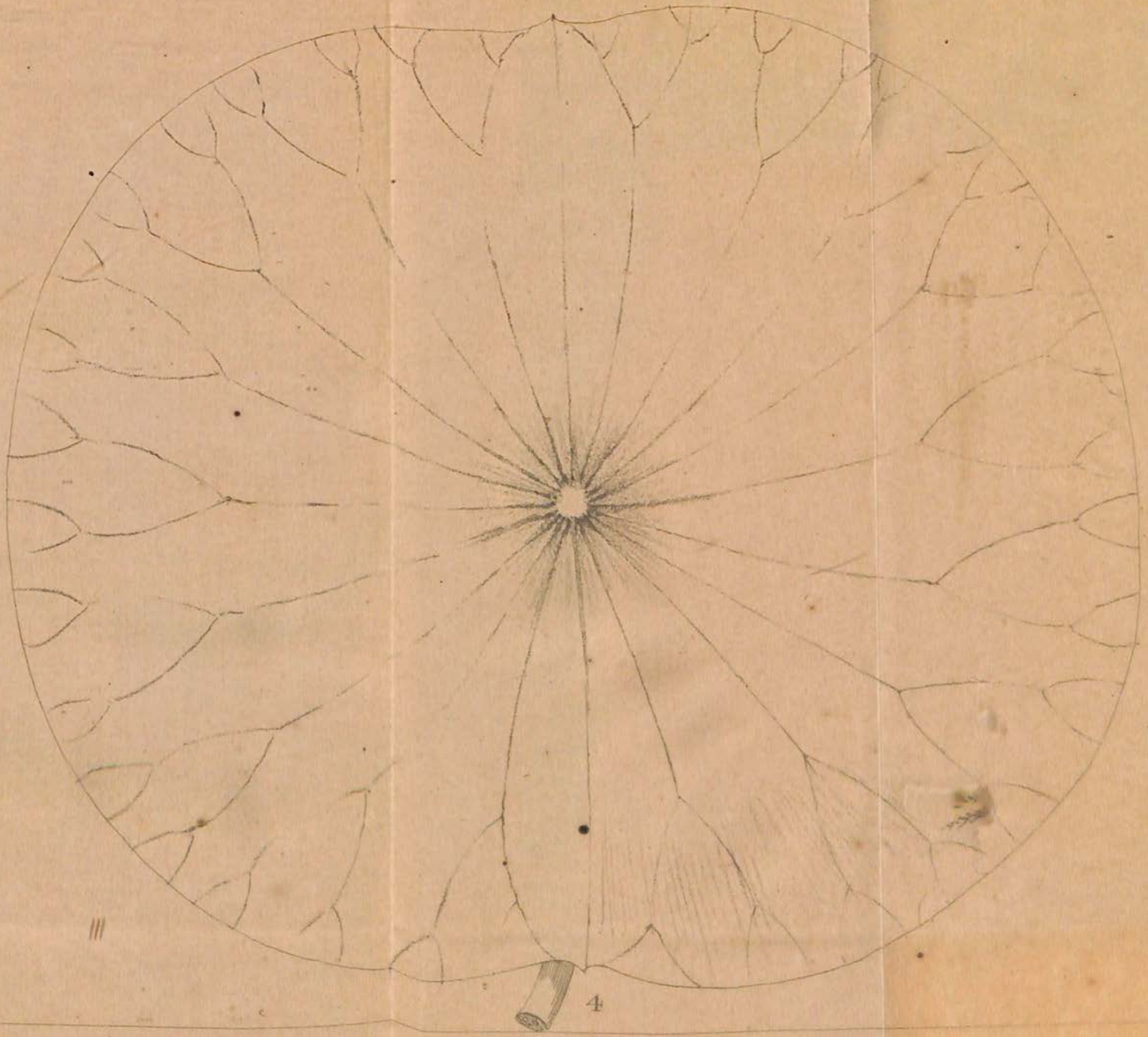
Stalk Sections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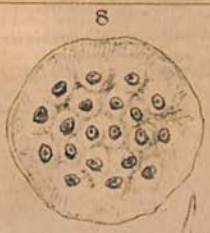
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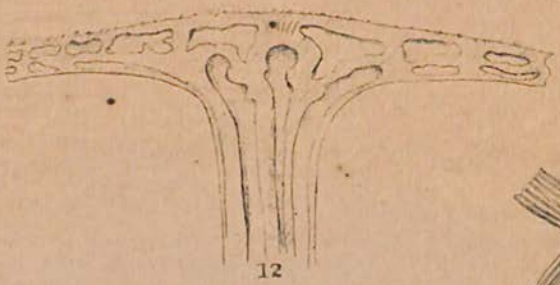

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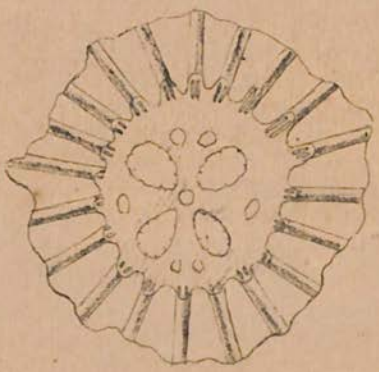

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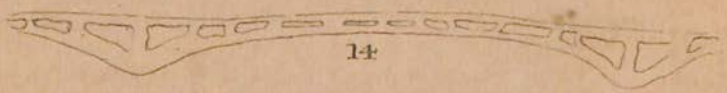

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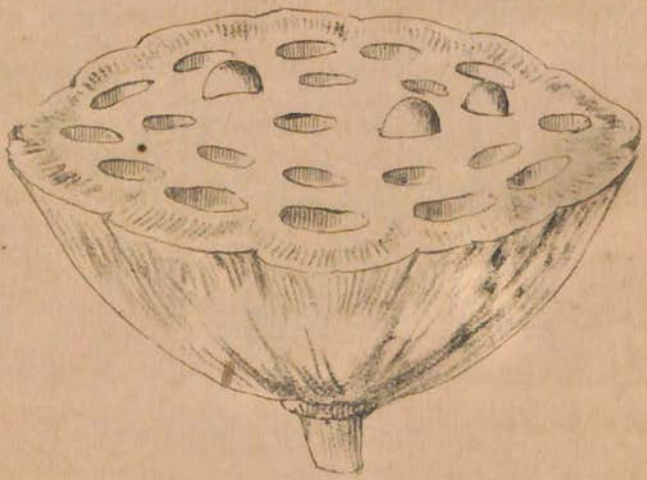

ART. II.—*Notes on a Journey through part of Kattiawar and Goozerat in Jan.* 1855. By DR. GEORGE BUIST.

[Laid before the Society 15th March, 1855.]

IN presenting the following notes to the Society, it may be as well to premise, that though the districts traversed are in our immediate neighbourhood and have so long been familiar to us, that there might seem little to be seen in them requiring to be described which had not been so before, I found them so full of matters of interest never touched on by any one, that I could have supposed myself in the wastes of Africa or wilds of the Himmalayas, rather than in regions not 400 miles from the presidency, and which had for nearly half a century been in a great measure in English hands. As qualifying this, it is proper to add, that my impressions were those of a Griffin of the purest sort; and that though most parts of the presidency were as familiar to me as books, letters and conversation could well make them, all my knowledge of it was derived from secondary sources. The duties of a laborious profession had kept me chained to the Island during nearly the entire fourteen years of my residence in India; and though from 1840 within sight of the mainland, I had in reality never been a score of miles from my office, excepting on a few transient occasions when my own sickness, or that of my family, compelled a hurried change of air and scene—to Poonah, Mahabuleshwur, or Surat, under circumstances as unsuitable as might be for enjoyment or observation. The delight felt by one devoted to travel, and who seemed destined to close his connection with India before he had so much as had a look of it, may be imagined, when circumstances arose in the end of 1854 affording the hope of an excursion from which the utmost gratification was looked for, and as it turned out—not in vain.

My observations from first to last are to be received as those of a Griffin on his first journey, to whom many things perfectly familiar "TO OLD INDIANS" appeared new, and where astonishment may have been created by what more experienced men would have passed unmoved.

I have generally found instruments and books, even though the bulk of these might afterwards prove superfluous, so much of a conveniency and possible source of enlightenment, that I have throughout my limited wanderings indulged more in an excess of this variety of lumber than in that ordinarily preferred, and not unfrequently deemed essential by Indian travellers, and now provided myself with an abundant supply.*

* I took three sets of Thermometers, three Barometers—one of which was proposed to be left at Broach. It was wished to leave the party desiring them a choice; one Barometer would otherwise have sufficed. A Daniell's Hygrometer. A Prismatic Compass. Common

I took with me a very intelligent Parsee, at the time Clerk under me in the Geographical Society; from 1842 to 1845 one of my assistants in the Observatory,—a strong, able, clever fellow who spoke Goozerati well, could always be trusted, and was willing to put his hand to anything. I found him of the greatest assistance to me, and have much gratification in acknowledging my obligations to one long a fellow-labourer, and always, I hope, a friend.

To a Griffin ignorant of Indian travelling arrangements, it does not at first occur that conveyances may be three or four hours behind their time of starting without their dreaming of having committed any impropriety. I meant to proceed by the good steamer *Elphinstone*, advertised to sail at two o'clock from opposite the Apollo Pier; and having almost as little idea of being half an hour too soon, as half a second too late, proposed to be in office from noon till half-past one, when at the earlier hour a message reached me that the ship was starting. My reply was, that I had sent my luggage on board, and should follow at the time advertised; if the vessel left her anchor before this, I should most certainly prosecute the proprietors.

I got on deck accordingly at two precisely, and cast about, but in vain, for some one to shew me my quarters. My traps were carried below and stowed away as seemed most expedient and being now all safe, I looked about everywhere for the people connected with the ship, to see when we really were to start. At length after no end of conjectures, I discerned a pleasant-looking country-born lad, remarkable chiefly for his devotion to tobacco—my pet aversion, I may remark in passing—surrounded with smoke and a host of people, but paying no attention apparently to anything save his pipe, none certainly to the passengers. This turned out to be the Captain, and a very good officer and worthy fellow he proved to be; but certainly nothing could be more unlike the demeanour of commanders of passenger vessels in Europe, than that of the supreme authority of the *Elphinstone* to those under

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pocket Compass. A five inch Theodolite. Two Tape lines—12 feet and 60. A couple of common Mountain 4 feet Telescope. Plummit for measuring Wells. Copper vessels for drawing water from any depth desired. A tin pot for specimens of surface Water. An insect net and boxes for Insects. Blotsheet Portfolio for Plants, Two dozen. Four ounce phials for specimens of Water and deliquescent soils or salts. Small paper bags for Earths. Waste paper for Geological specimens, and thick soft paper for transferring inscriptions. Nitrate of Silver; Nitric and Muriatic Acids. Solution of Gall's. Strong Spirits. Poison solutions;—with a goodly supply of odds and ends. The first of the Barometers was broken on the way; a beautiful instrument made by Adie of Edinburgh for observation in Palestine. On the way out two of the passengers, under special obligation to the party, had chosen to start from the centre station an hour before the time agreed on, and when I was out making drawings of the Tree of the Desert. The barometer, which I never left out of sight, had been laid on my couch pending my return. It was sent after the van by an Arab horsemen, and of course smashed. On the way to Baroda in the extremity of my care, I had it strapped up at an angle of about 70, close by me in the bullock carriage: the concussions of Goozerat roads appeared to have caused the shaking of the mercury to break the tube betwixt the supports.

him. Like master, like man; and I found the same free and easy feeling exhibited by the Captain prevalent amongst the subordinates,—one of whom had provided himself with a new Accordion, with which he amused himself when the passengers were in bed, to the very serious interruption of their slumbers.

Bombay passenger ships had, as I now discovered, no particular time of starting; they waited till they had all they wanted on board without any heed to the hour advertised for departure. The result of course is, that every one waits till the last; the punctual incur a serious loss of time, and those who have too great faith in unbounded delatoriness not unfrequently lose their passages. Both evils would be remedied were the hour fixed adhered to without any countervailing disadvantage whatever.

I employed the undesired leisure thus allowed in making a most superfluous number of observations on the temperature of the water at the surface, and all the way down to the bottom, some 30 feet, and found it uniformly .79° —the same as that of the breeze at the time,—a not very wonderful or important result.

VERSOVA.—At last at five o'clock we got under weigh, and kept land in sight till opposite Versova, a little island forming one of the Bombay group to the north-eastward of Salsette—

> "A pretty place, 'tis said, in days of yore,
> But something ails it now—the place seems curst."

Salsette and the adjoining islands originally belonged to the Mogul province of Aurungabad. At the time the Portuguese were making preparations (1770) in hope of recovering their lost possessions, the Bombay Government availed themselves of the disturbances at the Court of Poonah to obtain, on consideration of assistance rendered the Peishwa, the cession of Salsette and Bassein by the treaty of 1775--more than a century after Bombay had been in our hands. The whole of these, with the entire group of adjoining islands were ultimately occupied by us in 1778. *

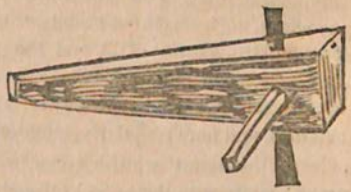
Versova is one of the many little islands, themselves adorned with islets of still lesser size off their shores, which decorate the coast all along from Bombay north and south; the Bombay group, properly so called, consisting of fourteen. At the entrance of the Creek which divides it from Salsette, on a fine bold promontory of basaltic columns of much beauty though of mode-

* Of course we did not land at Versova from the steamer, nor did I see any of the things here described on my night voyage to Surat in January 1845. Five years before (February 1850) when suffering from a severe attack of sickness, I was ordered to take a sea voyage to the Northward. The government Pattimar *Bhawna* was placed at my disposal, and as the wind was dead ahead, and I was bound for nowhere in particular, I landed as often as possible.—The anachronism of placing Versova and a few places on Perim within the present notice will, I dare say, be forgiven.

rate height, is a fort of very much the appearance of those of Mahim, Sewree, Sion and Worlee, but somewhat larger in point of size. There seems no date inscribed on it: from its aspect it might at first sight have been supposed of the age of those just named, but they were built by the English about the year 1700;—we in reality had no buildings beyond Mahim for eighty years after this. Besides, the fort of Versova contains a Church, and a place of worship is generally the last thing an Englishman thinks of in India: the theatre, racket court, ball-room, and race course, come first—churches are built when there is nothing else to be done, and people would rather hear a sermon than be idle. About forty years ago Versova was the training place for Cadets, after Old Woman's Island or little Colaba, and afterwards Mahim College had been abandoned; a party of Artillery, and afterwards of Sappers and Miners, from 1800 to 1804 were stationed at Versova: there are still some remains of the quarters they occupied. The side wall of a handsome house,—a flight of steps, still in good preservation, leading to a platform which commands one of the most beautiful views that can be imagined,—indicate where the commanding officer once dwelt: but the walls have been mostly built with mud and stone, only *pointed* with chunam. That most magnificent of architects, the Banian tree—which in itself furnishes forth a temple, a camp, or a caravanserai, and, as if in rivalry, rends to pieces all structures reared by human hands—had fixed its fangs in every crevice, tearing the most solid walls as if in sport asunder. The view from this shows how little way the voyager has got from Bombay. Just across by Mahim is Neats Tongue, apparently scarce ten miles off: along the coast Nossa Senhora de Monte is conspicuous, Worlee Fort, Love-Grove, the Temple of Mahaluximee, Tardeo and Malabar Hills are all in view. On the other side the creek runs some way inland, and then branches off into another creek, forming other islets: further on it expands into a lake. Other islands and other creeks follow in succession on to the desolate city of Bassein. A little way up the creek, and right opposite the fort, is a large, populous, and thriving fishing village. A fleet of boats, partly drawn up upon the beach, in part at anchor off the shore, indicates the industry and wealth of the people. A high sand-bank divides the creek from the houses of the fishermen, and here is seen in abundance the iron dust used in Bombay for sanding damp MSS. The spare spars, nets, and fishing tackle, are deposited on a framing raised on posts over a large expanse, about six feet above the ground—a sort of roof is thrown over them, so that work may be carried on in partial shade either in the first or second floor.

Here are to be seen in abundance on the beach those curious stone anchors still employed by the fishermen of Wales and Cornwall, and which along our

coasts are almost universal. The fisherman's mooring anchor is generally of stone, from four to five feet in length, of the form represented in the adjoining drawing. The stone is four-sided and pyramidal—the apex cut off. At its base it is from six to eight inches square, and from four to six at top. Through the top is a hole, through which a cable or hawser passes. Near the base are two holes at right angles to each other: through these pieces of wood are thrust, corresponding to the prongs or flukes of the anchor. The whole weighs from 80 to 150 lbs. according to the size of the vessel, and answers very well the purposes intended. These anchors are most commonly made of limestone, and are on the whole efficient, unless in heavy gales.



Though the habitations of the living can hardly be traced at Versova, the frail monuments of the dead are still entire. From the roadstead three modest tombs on a little grassy promontory close by are to be seen: on the middle one alone is an inscription—those to the right and left only indicate that the sleeper rests not in solitude—the names of her companions are not given. The following is the inscription on the centre tomb:—

Within this tomb
The Earthly Remains of MRS. CAROLINE REBENNACK,
Wife of Captain REBENNACK, of the Engineers,
are deposited.
She was born at Stuttgardt, in Wurtemberg, 7th November, 1799,
and died at Versova, 1807.

Mildness of manner, sweetness of temper, and amiability of disposition, procured her a circle of friends as sincere as they were general, their friendship being in esteem for her many virtues, both moral and domestic: the affection she evinced for her family endeared her to a husband who is, by her removal, rendered miserable, and would be inconsolable were it not for the pious and placid resignation with which she bore her sickness and sufferings, and which leaves no doubt but she will enjoy the reward promised to those who live and [*word broken off*] truly Christians.

There seems always something singularly touching in a solitary grave—especially if it be that of woman. Here the sorrowing husband left all that was most dear to him: how few have so much as read or known the words in which he uttered his sorrow! Does European eye once in ten years rest on the modest monument erected over the wife's remains? And where sleeps he—for doubtless he has slept for years—parted afar from the idol of his affections? The dead feel no solitude, know no separation, yet to the living it seems that the sepulchres of those who where loving in their lives ought not in death to be parted,—and that it might have been some consolation to think that they should rest together, and in some quiet churchyard, near the ashes

of their kindred, and that one stone should cover them, or bear their names.

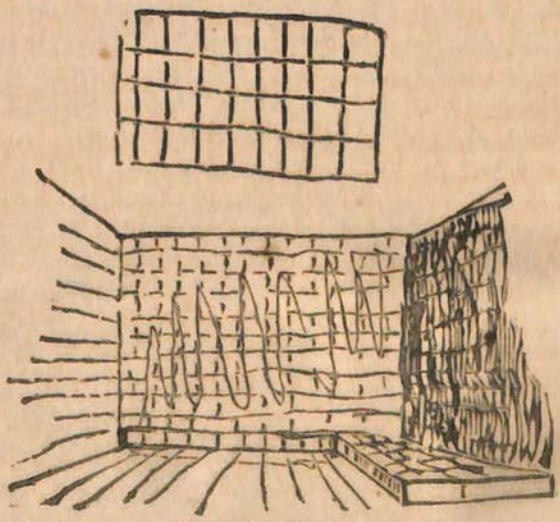
A little way north of the fort is the fishing village of Versova,—a considerable hamlet, in no way distinguishable from those of kindred sort along the shore. The vein of basalt which constitutes Malabar Point and Hill, Tardeo Hill, Worlee Hill, and the promontory and ridge of Nossa Senhora de Monte at Bandora, runs along the shore in nearly a straight line in the form of a narrow dyke. At Versova it exhibits a series of fragments of imperfect columns, and here singularly, though black externally, it is on the landward side of the finest whitish green, with crystals of augite —on the sea front greyish white with the aspect of sandstone. It rings like cast-iron when struck, and leaves no doubt as to its volcanic origin. It seems to have formed the main barrier betwixt the sea and the shore, the ground being here almost everywhere so flat,as to be, but for this, liable to invasion from the waves. On a little detached islet of rock some thirty yards or so just off the entrance to the harbour, is a small Mahratta fortalice. A couple of miles further north is a long belt of cocoanuts, and in the midst of them a large Portuguese Church in

PORTUGUESE CHURCH, NORTH OF VERSOVA.

a state of extreme delapidation. A wooden image of some saint or other, like a large doll, stands on the highest of a flight of steps, with little lamps of cocoanut shell all around him. It is hard indeed to perceive any greater idolatry here, in Hindoo than in Catholic worship, and the natives clearly imagine that this variety of Christianity differs very little from their own religion. At the college of Mahim we once witnessed a procession from the Church round the tank: the Hindoo who was with us, on seeing the image of our Saviour, said—"Oh! that is not their principal God—they have other two besides that, and one of them is much greater." In this light the image at Versova, and indeed at all other Portuguese Churches, seemed to be viewed.

It is here that the shell sandstone, or littoral concrete, is quarried in greatest abundance. Littoral-concrete is a variety of rock which has not hitherto found a specific place in our geological catalogues:—the name has been con-

ferred on it from its being invariably found close by the seashore, and from its resemblance to the artificial stone formed by the cementation of sand, gravel, or other coarse material, by limewater or mortar. It is composed of the material prevailing on our shores—of shells, sand, gravel, and pebbles,—and varries in its character with the rocks in the neighbourhood ;—being micaceous towards Cochin and Tellicherry, from the quantity of sand and other nodules from the granite and gneiss ; gravelly to the north of Bombay, and around us composed almost entirely of fragments of shells. It is to be met with only in the regions where rains abound. Along the shores of Scinde, Arabia, and the Red Sea, though the material composing it is abundant in positions similar to those in which it exists on the Malabar Coast, it is nowhere cemented into stone. Even here, indeed, the cementation is far from invariable : in one part of the Bombay esplanade we have loose sand at the surface, and concrete beneath : at another, sand or concrete, as the case may be, from the surface throughout to the rock : and in a recent excavation concrete was found for the first twenty feet resting on a bed of fine sand perfectly loose. It is frequently found to rest – as for example at Sewree and Mahim—on a bed of blue clay filled with kunkur and mangrove roots, offering evidence of a depression from the time the mangroves grew at high-water-mark, so as to permit the gravel deposit to accumulate. The whole must then have been raised by a



QUARRY AT VERSOVA.

second upheaval to its present level. Our principal quarries of this are at Versova.

The sand, which seldom extends more than a few inches down, is first re-

moved, and the rock smoothed on the surface. A space about twelve feet each way is next divided into slabs one foot square, the grooves between them being cut with a light flat-pointed single-bladed pick. These are raised successively by a tool something between an adze and a mattock, a single stroke of which is in general sufficient for the detachment of each from its bed. The blocks thus cut out and raised being thrown aside, the bed is once more smoothed, and the operation resumed till the pit reaches the depth of six or eight feet, when, it being no longer convenient to remove the stones by hand or basket, a new pit is cut. This variety of building material is brought in vast quantities to Bombay, where a large portion of the native houses are constructed of it. It is not very strong, but with the admirable cement employed with such lavish hand, it makes a good and economical wall.

The belt of land fairly elevated above the highest tides does not here exceed a quarter of a mile in breadth: behind comes a vast flat of mud – a mangrove marsh, more or less covered once in twenty-four hours by the sea. As usual, the sandy spit, or concrete ridge, is fit only for the growth of cocoanuts, but it abounds in fine pure water. Betwixt this and the swamp is a bed of fine rich brown earth, on which there are the remains of a large and handsome garden, now totally neglected, but which appears to have been within these few years under cultivation. One leaf of a gate hangs by a single crook—the other leaf has been broken up and used for fire-wood. Large pieces of the wall have fallen down – the portions still standing are swayed in all directions from the perpendicular. The aqueducts, which seem to have been numerous and neatly built, are broken down, cracked, and useless. A grotesque head, which once poured water into a stone basin, and bears a Persian inscription beneath has now a sinecure – its lips are parched, and the trough is choked with weeds. Wells abound everywhere around, but they are nearly choked up: water is found in plenty at the depth of fifteen feet, but there is no need of it—the fruitful garden has become a wilderness,—where the rose blossomed and the rose-tree still exists, is a waste,—the dwelling-places of the land are desolate. Around the fort of Versova a Parsee has laid out large plantations of mangoes: they yet barely show above the ground—to the north the result of industry has not yet made its appearance. It is hard to explain how such things as this should have appeared under the benign influence of our paternal government: but they are so everywhere. The bund is broken, the aqueduct unserviceable, the tanks filled up. Forts, gardens, churches, and temples—the monuments alike of paganism, and Catholicism—are all in equal delapidation: a dreamy helplessness, spiritless apathy, broods everywhere over a poverty-stricken people. The scene just described is within two hours' sail of the island of Bombay, with its half million of mouths to fill: here are soil, climate, water,

and the means of carriage in abundance : here are the vestiges of human industry and rich rural cultivation, but the vestiges only—all is now desolation and decay.

In visiting these curious old places along shore, one is filled with regret that no popular history, guide book or hand-book exists to enlighten the traveller as to the singular scenes around him. Along the shores of the Gulf of Cambay we have large forts scarcely yet dismantled, the rusty guns still scattered around, the gates not unhinged ; places of worship, temples beginning to fall to decay, in reference to all of which there must be a large store of information buried in the public archives.

The same thing is still more strikingly the case the more to the southward. From the entrance of Bombay Harbour for nearly a hundred miles along the coast, we have fort after fort, stronghold after stronghold, all tenanted within these 70 years, utterly neglected or unknown. Yet these were almost till our own time retained by the chiefs of the country, with whose history and adventures much of our own is so closely interwoven. We have few pleasure parties or holiday makings in the East, but public officers on their way to and from the scenes of their daily toil must be constantly passing scenes and objects in reference to which it would be most desirable for them to be informed, and over which darkness and mystery are only suffered to brood because—we are in India !

About 5 A. M. on the morning of the 3rd, we had a fresh breeze from the south with threatening clouds, and soon afterwards a heavy shower of rain—a somewhat rare thing at this season. The moon was just past full, and we had, as the shower passed to the eastward, one of the finest lunar rainbows I have seen :—not a circle round the moon, but a fragment of an arch rising from the horizon to more than half way up the zenith, and faintly tinged with prismatic colours. The Gulf of Cambay is remarkable for the height and strength of its tides—at half-tide the stream rushes along like a mill race, often attaining a velocity of six or seven miles an hour, and then sailing vessels meeting it generally anchor for an hour or two until the current slackens. It is very beautiful to see—as I have sometimes seen, a fleet of thirty or forty Native craft all anchoring just at sunset : should this be the time of half tide, within a mile or two of each other, all found at anchor as the morning dawns, and with the first rays of the rising sun when the land wind blows, setting sail simultaneously as if in concert and hurrying on their voyage. It is said that some half century ago when these seas swarmed with privateers, a fast sailing brig pursued up the Gulf of Cambay a Government Pattimar carrying treasure. The sea breeze was fresh, the tide slack, and the pursuer was rapidly gaining on the pursued—not knowing that as evening closed in the wind would go down and the half

ebb tide become irresistible. Towards twilight the Pattimar spread every inch of cloth she could command, and began to water her sails as the tide became too strong for them, determined to all appearance to spare no means of escape. At the same time she dropped her anchor unseen to the enemy, who copied her in everything save this. As night drew on the breeze died away—the Pattimar remained where she was, her pursuer drifted at the rate of eight miles an hour astern. It was low water at 10 P. M., and with a light breath of air and rising tide the chase shot ahead, and by daybreak was out of sight of her pursuer. So much for a practical application of the "Maurey system" fifty years ago. Know the winds and waves, and fear not. We reached Surat at three in the afternoon. (A notice of the town, environs and river will be found under the head of the returning voyage.) I was anxious to make a series of experiments as to how the salt and fresh water tides commingled with each other, and immediately took a boat and proceeded some seven miles down the river making all sorts of observations as we went. On my return three weeks afterwards many of these were repeated with still greater care. The details are given at the conclusion. These operations have hitherto been without results, because from a severe and long protracted sickness which overtook me on my return to Bombay, and a large extra load of work which followed almost immediately afterwards, I have never yet been able to analyse the specimens of water then collected, and which have stood bottled up ever since.

It may be mentioned generally, that some thirty years ago that distinguished naturalist Dr. John Fleming, found by a series of experiments on the river Tay in Scotland, that the ascending sea tide pushes itself forward and afterwards withdraws like a wedge under the fresh water—lifting it up and forcing it back without materially mingling with it save on shallows or along the shore. The phenomenon is what ought to have been expected on the common laws of hydrostatics, and is, I have no doubt, general. One would at the same time have liked to have known how matters actually stood in the Taptee. This was my object in prosecuting the researches just detailed,—want of time compelled me to stop short before reaching any definite conclusion.

Having spent one night at Surat, during which I sauntered, under the light of the moon—then nearly full, through the whole dull, straggling and slovenly city—the first of our possessions in Western India, and then slept on board; we started with early dawn across the Gulf, for Gogo, the principal port in this quarter of Kattiawar, and got sight of land about 2 in the afternoon disembarking about 3 o'clock.

Here I expected a conveyance to meet me from Bhownuggur, and accordingly found my friends punctual and precise as the Horse Guards' clock.

An excellent spring bullock cart covered and fitted for sleeping in, was in attendance for my own use, provided with a pair of magnificent Kattiawar oxen, with two country carts for my baggage and servants.

I had on one occasion endeavoured to confer some services on the Bombay Agent of the Thakoor of Bhownuggur, and he never seemed to think he could do enough for me. I mention this as explaining the manner in which I travelled, and kindness I received while in his dominions.

GOGO, or GOGAH.—As it is more correctly spelt, is a considerable seaport on the south-eastern extremity of the Peninsula of Kattiawar. It presents a pretty, indeed almost a striking picture from the sea, from the apparent size and regularity of some of its buildings, the beauty of the trees, and symmetry of the town wall ; the expectation awakened by these are not realized on landing. It is without any pier or harbour, but being well sheltered from the S. W. monsoon, the roadstead affording good anchorage, with a clean sloping gravel beach along shore, it is rather a favorite place of resort for Native craft. A strong well-built sea wall extends for about half a mile along shore, and there is a little creek or natural shallow or basin where vessels of light draft of water haul up, and close by which boats are built. The custom house and traveller's bungalow are the buildings nearest the shore that first arrest the eye; beyond the second of these is a large native burying ground, and still further on, a neat pretty looking dwelling-house, the residence of the Collector, Mr. Stewart, an uncovenanted assistant, generally known by the familiar name of Gogo Stewart, and universally respected for his intelligence, uprightness, kindness, and hospitality wherever he is known. Much of the ground in and around Gogo is but a few feet elevated above the sea ; it is covered with sea shells and gravel, and is obviously part of that very recent marine formation which girdles the greater part of the seaboard of India. The rock consists of a tertiary sandstone passing into very rough conglomerate and abounding with fossil bones ;—the same as those of Perim, close by.* The surface runs here and there into large angular mounds covered partially with yellow, chiefly with black, cotton soil or regur. In the cracks of some portions of this I found a singular form of plated Kunkur, pure and partially crystallised. One peculiarity difficult to be accounted for lay in this : the calcareous matter must have been deposited when the clay was dry and cracked, and could in this case only have been formed from a solution—probably it appeared in the shape of a film of moisture drawn up by capillarity, and depositing its lime in successive layers on the surface of the crack. A thin scale once formed and the mould for the casting established, subsequent depositions might go on at

* See Captain Fulljames on the Fossils of Kattiawar—and Mr. Orlebar on the Geology of Goozerat.—*Journal of Bombay Asiatic Society, Vol. I.*

leisure. When picked out of the bank, the crevices were full of clay ; when this was washed out the specimens presented the appearance of a congeries of Septaria. There are abundance of freshwater pools and marshes all around and two pretty little lakes just beyond the walls of Gogo, formed by ponding across an opening the natural hollows which form their beds. In journeying this season, as in March five years before, I found them full of beautifully pure water, now running out in trickling rivulets. They are surrounded by trees, abound in water plants, and are covered with duck, teel, and other varieties of wild fowl. There are several highly ornamented wells in the neighbourhood descended to by flights of steps ; one is twenty, one forty feet deep and about twenty below the level of the sea, and indicate a state of wealth and taste very much beyond any now apparently existing. The town is surrounded by a wall* about three miles in circuit, with round towers, mostly of late years rebuilt or thoroughly repaired, and valued as preventing plunder : a band of determined men, even without the assistance of artillery, might readily make their way into the town ; from single or small knots of thieves, the wall affords a very desirable protection. A tolerably strong fort at one time existed here, the foundations are all that now remain.

The town forms the head quarters of the Presbyterian Ulster Mission for Kattiawar ; the members of which have devoted themselves with such untiring zeal to the extension of religion, and even where they have failed to make proselytes have conferred such benefits on the cause of Education. The Revd. Mr. Glasgow and Revd. Mr. McKie are at present the resident missionaries.

In 1836, Captain Fulljames made a boring in quest of water close by Gogo Creek near the bunder, when after passing through many different strata of conglomerate, a bed of sandstone thirty-five feet thick, a stiff black and bluish clay was met with holding balls of Septaria, and this to the depth of 360 feet was never penetrated. No water was found to follow the bore—the deepest in India, save that under Fort William—481 feet deep.

On the present occasion I quitted Gogo for Bhownuggur, the evening of the day of my arrival (4th) ; but as no account of the Island of Perim has ever appeared in our Transactions, I may give the results of a visit to it in March 1850, —taking the benefit while doing so of the information contained in the various papers that have been published regarding it in the Journals of the Bombay, the Bengal, and the London Asiatic Societies.

* I found several very good specimens of the teeth and bones of Saurians on examining the wall in 1850, and obtained a very beautiful collection of Perim bones from Mr. Stewart with several others collected by Mr. Bettington, C. S.

PERIM.—Is a small island about three miles in circumference nearly opposite the debouchure of the Nerbudda on the further side of the Bay, and about a third of a mile from the coast of Kattiawar, from which it is separated by a channel about 300 feet in depth. It first became famous about the year 1836, from the enormous number of magnificent fossils discovered on it by Baron Hugel and Dr. Lush, and described by them in the Journals of the Bengal, Bombay, and London Asiatic Societies. It is about twelve miles from Gogo; as it is approached, the spectator is bewildered by the appearance of a plantation of apparently large trees surrounding it, the mangrove bushes on its shores being magnified by the mirage into a forest. The island is surrounded everywhere by coarse stratified sandstone, alternating with conglomerate. This to the southward is left dry at low water for upwards of a mile. The island, indeed, when the tide is out, exhibits twenty times the area it presents at high water—being in the former case nine miles in length, and three across. The rocks abound everywhere with masses of petrified wood, which in all cases appears to have been in a state of extreme decay when the process of mineralization began. It is bored full of worm holes which all proceed from the lower side upwards, and these are generally lined with incrustations of siliceous or calcareous spar—the body of the mass being a dark chesnut brown jasper. This variety of fossil exists in such abundance that there is no fear of exhausting the supply. The bones and other petrifactions found in such profusion thirty years ago, when the place first became known to Geologists, have been so largely drawn upon by travellers, that they are now very rarely to be met with *in situ*—though some baskets full are always brought by the fishermen for sale to the traveller, and it is singular how correctly they are generally named by these simple people who, it is to be presumed, are in this only repeating what they have been told. I had taken with me a Bombay quarryman, well provided with gunpowder and tools; the only thing we found was one fine large vertebra of some gigantic form of fish. The prospect was so unpromising that I made no attempt to blast. The sea has every appearance of having of late everywhere greatly encroached upon the shore, and it is more than likely that at no great distance of time the whole will be swept away. The likelihood is, indeed, that at one period, probably not very remote, the bulk of what is now submerged by the tide was dry land, and a part of the reef bearing from the lighthouse S. and by E., and distant from it more than two miles near spring-tide low water, presents two large stone elephants cut with their pedestals out of the solid rock, and which never appear to have been moved from the spot where they were sculptured.* In their present

* Paper by Mr. Lumsden in the first volume of the Journal of the Bombay Asiatic Society 1841. p. 29. Mr. Lumsden gives us the dimensions of the figures: they are seven feet six from head to tail—four feet six across the back, and six feet six from foot to shoulder.

position the workmen could only have worked for a few hours at a time once every fortnight. A long lapse of years would thus have been requisite for the completion of the task, which when finished would have been fruitless, the stones themselves remaining beneath the waves. Their removal could hardly have been contemplated, as the rock is the same here as that presented at highwater, and the blocks, besides the difficulty of reaching them, weigh close on twenty tons apiece. As this is in the region of terrestrial undulations, it seems more than likely that the shores of Perim have sunk down ten feet since these mysterious sculptures were executed—perhaps within the past 800 years. The fossils here are the same as those which prevail in the rocks of Upper Sinde, throughout a large part of Kattiawar, and so across the Gulf along the line of the Nerbudda—far into Central India. They are the same as those in such profusion in the Sewalik Hills, and lower Himalayas, so extending to Ava and along the banks of the Irrawaddy. They present fragments of extinct varieties of elephant, rhinoceros, hippopotamus, horse, ox and antelope, with several forms of crocodile, fresh water tortoises, and fishes of the most gigantic dimensions. There are two classes of Titanic ruminants which seem to have no living types; they have been termed the Bramatherium and Sivatherium—the beasts of Bramah and Siva. About two-thirds of the island are covered with drift sand, the rest is a light brownish cultivable soil. On the western side there are some low cliffs rising from the sea shore, consisting of conglomerates and indurated clays, the same as the rock around covered with loose gravel and sand. There are five or six wells on the island, but what surprised me most of all was, the appearance of a group of large pools of water from fifty to seventy yards in diameter, and in the beginning of March from three to six feet in depth. They were devoid of vegetation even at the borders, the water perfectly pellucid, and apparently pure. The surface of the pools seemed somewhat under that of the sea, but I had no means of ascertaining the fact by measurement. The evaporation here cannot be less throughout the fair season than a quarter of an inch daily. Within the five months elapsing since the last shower fell, the surface of the lakes must have been lowered four feet at least by this means alone. The sand is too loose to indicate the line of shore at their highest, but when full they must be five or six times as extensive as they were at the time when I saw them. A portion of the island has at one time been surrounded by a strong wall, and there are still numerous fragments of buildings traceable upon it, and sculptures of no mean merit, considering the intractable nature of the material, may occasionally be met in with. Tradition universally ascribes these works to a powerful Rajput chief named Mackra Goil, ancestor of the present Thackoor of Bhownuggur.*

* Mr. Lumsden, Bombay Journal *ut supra*.

From him seem to have been descended many of the principal Kattiawar chiefs. He retired to Perim about the end of the 13th century, and was afterwards slain in battle by troops from Delhi. Perim was at one time believed to promise a suitable sanatarium for those requiring sea-air, and some troops were accordingly about twenty years since quartered on it, when it turned out so unhealthy as to compel its own scanty population to leave it as the hot season approaches, and to absent themselves till the opening of the cold weather. They consist of some twelve families in all, who occupy themselves partly as cultivators, in part as fishermen. They look sickly and seem miserably poor.

The Island of Perim belongs to Kusbatees of Gogo, named Mosumbhaee and Zacoobjee, to whose forefathers it was granted in free gift by the King of Delhi, under whose seal they enjoy it to the present day free of rent.*

In 1838, a light was erected on a sandy eminence some fifty feet above high water. It consists of a round stone tower thirty feet high, with a tall mast with a lantern on the top about sixty feet more. It is found of much use to mariners; it is abandoned from May till October—the island then being uninhabitable. It is in the bungalow adjoining that travellers find quarters, much more neat and cleanly than, and with civilities from the lighthouse people not often met with, at places of much greater pretension. Perim measured both ways from the lighthouse is four miles from the nearest point of the Kattiawar shore, and about eleven from the promontory north of the mouth of the Nerbudda. The channels in both cases considering their width are singularly deep, varying from thirty to sixty fathoms, the greatest depth being close to the island, which in some places seems almost precipitous. The tide rushes past with great violence, and its sound heard from the lighthouse is like that of a distant cataract. The stream is here confined to a channel about one-fourth the section of that which it occupies some thirty miles lower down. From this northward the bay expands and shoals towards the mouth of the Mhye and Subburmutti, and these peculiarities give us the Bore. The wave generally commences as the springs begin to lift, increasing daily in height as the tides gain in strength—reaching its maximum about two days after full and change. It is greatest with the new moon at Peragee, and during the day or night according to the season of the year. The night tides being higher by six feet than the day in winter, and converse ways in summer. Neap tides have a sweep of about eighteen feet, ordinary springs about twenty-five, and extreme springs about thirty :—When the Bore rushes up at the rate of seven

* Government Records, No. V, 1956. Collectorate of Ahmedabad.

or eight miles an hour, and there is frequently a rise of eighteen feet in a single hour.*

GOGO TO BHOWNUGGUR.—Once more returning to the mainland :—we started from Gogo close on sunset. For a mile or two we had the benefit of an excellent road now in process of construction through Kattiawar and so on to Ahmedabad. We now had lost the sun, but the moon was in full splendour, as we struck off by an unformed track through rough ground keeping the line of the seashore. We had scarcely proceeded a mile, when one of our wheels plunged axle deep into a swampy portion of a little brook not six feet across : the driver first struggled hard to get the bullocks to extricate us, but in vain. Nothing a Native seems to detest so much as to put his hand to the wheel when his cattle can help him : no matter what the sacrifice of time so that exertion is spared. My Parsee companion and I having unyoked the bullocks and lifted out the carriage, the driver was on the point a second time of upsetting us, driving right in without observing the nature of the place at which he was to cross, when we stripped off our shoes and stockings, and wandering up and down for a score of yards or two, poked about till we found a firm bottom, a thing not at all difficult. While we were thus engaged, a train of carts following us got into the same plight as we had, at a brook some 300 yards behind, which we had crossed in safety. I went back to see if we could help them, but found the accident considered so very commonplace and so little formidable, that nothing whatever was thought of it and no assistance looked for. The other carts of the train had proceeded on without considering it requisite to assist their disabled companion, which was in the way of being put to rights in half an hour's time without aid, and there seemed no reason why we should concern ourselves more about the matter. The causes of these accidents are simple enough : so seemed the remedy. The little brooks here obviously scoop out from time to time cavities where the channel shortly before had been hard and firm. These becoming filled with black mud almost semifluid, are not discernible by the eye, though easily found out by a stick. To avoid them, all that is requisite is to resort to the precaution we ultimately fell back upon, and poke about for a firm place before fording is attempted. This is too much for the forethought of a native driver, who "clucks, clucks" the bullocks on trusting they will get through, as they generally do, and preferring the trouble of ultimately lifting out the cart, to the anxiety of watching to prevent its getting in.

* The whole facts in reference to the Bore are taken from an excellent Memoir by Captain Ethersey, published in the Royal Geographical Society's Transactions in 1838—republished in those of Bombay in 1844, and a few months since in one of the Government Selections

It was bright moonlight, so I walked most of the way to Bhownuggur, a distance of twelve miles. The country seemed rugged, rocky and sterile: it was not clear enough to allow me to see more minutely.

We found the travellers' bungalow clean and comfortable, and though not overprovided with night comforts—we had outstripped our baggage—a cool, or rather a cold night, and abundance of exercise, had secured for us sound sleep and an excellent appetite in the morning.*

Tuesday, January 5.—I got up at half-past five, and made a survey of the town. A strong N. W. wind blew, the thermometer was 58° and it felt cutting cold. On my first journey into the interior I had not calculated on so great a difference of temperature with so moderate a northing, and paid the penalty of Griffinism.

BHOWNUGGUR is a small seaport on a narrow sludgy creek on the western shore of the Gulf of Cambay, in latitude 21° 48 N., longitude 72° 16 E. The creek is about two miles across; spring tides which here rise above 30 feet come up close to the town, the portion covered at low water is about 300 yards wide and the creek is on the northern side. The river here, which threads its way through the mud, is navigable for five miles for native craft and to within a mile of the town, and Bombay steamers have sometimes got thus far. Boats of moderate size get as high as Wullee. The town itself is very tolerably built and surprizingly clean and orderly compared with its neighbours. It occupies the site of a village called Joona Warra, and was chiefly built about seventy years ago. The Bhownuggur princes have for a century been honorably distinguished for the protection given by them to commerce, and large numbers of Arab vessels were wont to frequent the port. Thirty years ago it used to be famous for

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*A notice of the observations has been reserved for the close of this paper, a few may be given as notes, so as to carry the reader who wishes to refer to them along, without encumbering the text.

Level of sea.	9 30 P. M.	Ther.	75°	Bar. 30 026 corrected for Temp.
5th January	6 30 A. M.	Ther.	60	29.960
	8.30	Ther	61	29 945
	9 45	Ther	67	30 041

range from 6.30 till 9.45—.01—probable range from 4 till 9—100; elevation at Bombay, January 5, 10 A. M.—.081 of 29.96, 4 P. M.—.065; range 111. My Barometer read 0.03 higher than that of the Observatory, which still makes the morning observation .011—or .035 higher than the Bombay reading; the estimated range (I have not the Bombay morning means, 100—which is probably correct. Both instruments and readings may be depended on. I have not given the correction for detention, unless when comparing my readings with those of Bombay. Dry bulb Thermometer at 8.30—58, wet 54, dew point of Daniell's 45. A cutting cold wind blew from the north and felt very freezing. The water of the lake in the centre of the town was 48° at daybreak.

the manufacture of all descriptions of counterfeit coin. This, from the great improvement of our coinage, and it is hoped also amendment in the morals of the people, has long since ceased.

The Chiefs belong to one of the oldest Hindoo families in India after that of Oodeypore. They were formerly tributaries to the Guicowar, to whom they paid Rs. 75,000 annually : this was in 1807, with consent of all parties, transferred to the British Government. This transfer conferred no authority to interfere with the affairs of the old hereditary dominions. In 1816 the Thakoor kept up a force of 900 infantry and 1000 horse ; these were maintained in a state of high efficiency, when they were, in 1820, greatly reduced. About this time a portion of his villages were sequestrated by the British Government, on the plea that he had hanged some plunderers who had not only stolen his cattle but slaughtered them--this last being sacrilege in a Hindoo state. This discussion has been maintained up to the present time: in 1853 the home authorities decided in his favour, but no redress has been received by him from those on the spot.

The rock around is a hard splintry trap, the soil scanty and arid, vegetation poor. About the middle of the town is a fine pool of fresh water nearly circular, and at the time I saw it about 200 yards in diameter.

We had received an intimation immediately on our arrival that we should be visited by the Thakoor's people next morning. A little after daybreak supplies of milk, bread and butter were received, and a short while afterwards two well-dressed and eminently intelligent looking gentlemen from the palace arrived, expressing a hope that we would make a stay of some dura tion and enjoy his Highness's hospitalities.

About 9, when we were closing our observations and winding up our arrangements, having breakfasted before, a party from the palace made their appearance. Two of them had visited us in the morning, a Hindoo and a Parsee,—the latter the philosopher apparently of the place. They were all fine intelligent looking, clear complexioned, handsome men : thoroughly well-bred fo any country, with the oriental politeness and urbanity which western nations cannot match. They were utterly devoid of that subserviency so unpleasant to a stranger, as much so of the offensive condescension which might not have been unnatural in the members of one of the oldest governments on this side of India, towards a wayfarer of no wealth or pretensions not belonging to the services, and connected with a profession not certainly entitled, from the fashion in which it is pursued in India, to any very high degree of respect from any quarter.

The turn-out was a curious one : the deputation consisted of the gentlemen just described : they brought the Thakoor's carriage, a very smart Long Acre

barouche, with a pair of beautiful Arabs in English harness, and the most picturesque of whips—a Bombay Parsee, on the box. The vehicle was at once overloaded for the execrable roads, which, even through the capital, resembled those which existed "before General Wade." We had horsemen and footmen, swordsmen and spearmen—fine powerful warlike fellows, but a good deal out of harmony with the carriage. The Bazaar was neat and clean, the shops quite as good as those within the best part of the Company's dominions which I have seen,—which certainly is saying very little either for my experience or the character of the shops. The people seemed healthy and well-conducted, and the absence of those precautions we observed everywhere else beyond the limits of the British rule, spoke favorably of the morals and the police of Bhownuggur. As we proceeded, I found that the wonder of wonders in the town was an English steeple clock, erected some thirty years ago, and kept in order by the Parsee philosopher to whom I have just referred. Never having been anywhere where steeple clocks were strange, I am afraid I did not express the wonder or admiration that seemed expected of me. It was want of thought on my part: the homage looked for by my Bhownuggur friends was perfectly reasonable on theirs. I doubt if there be another steeple clock in any town in India where there is no British resident, and where all the arrangements are purely and entirely Native. The front of the palace is new: it is built of the beautiful cream-colored Porebunder stone of which the Town Hall and other notable buildings of Bombay are constructed—a stone similar in tint and texture to that of the Bath oolite. The style of the architecture deserves mention. When fancying you are going to pass through a large arch into a spacious courtyard, you find yourself suddenly jerked into a narrow, steep, corkscrew stair on one side of the portico just as you enter, and where you have to guide your steps by a handrope. This, I believe, is a common arrangement—type of Native insecurity—while the entrance way leads to nothing in particular: that which conducts you to the great residence of the ruler is so arranged as to be defended by a single sentry.

Emerging from darkness at the top of the stair, we entered what seemed a large business room—the Revenue department as I understood,—filled with writers neatly dressed, busily occupied, and very like their work, and so we passed through other rooms or offices not at all got up for show most obviously, but in good working order and with every appearance of aptitude for work.

At length we reached the presence of the Thakoor, and were presented to a rather small sized darkish man, stately but thoroughly polite. The Durbar room was about 40 feet by 20, lined with dark panelling, and covered with mirrors and pictures,—neither certainly possessed of any great claims to

merit. The mirrors were those small wretched gilt framed things, about one foot by two, found in our pawnbrokers' shops at home and native houses at Bombay. The pictures were mostly Chinese copies of the wretched English colored prints of the last century,—George the III, Queen Charlotte, the landing of William, Buonaparte crossing the Alps, or fancy pieces supposed to represent the Great Mogul, with some twenty or thirty of the ancestors of the Thakoor. From behind a screen, as if scarcely fit company for such a gallaxy, were bought prints of Mountstuart Elphinstone and General Barr, obviously deemed the greatest men of modern times. The wonder out of doors had been the steeple clock,—the wonder in the palace was a musical timepiece, presented by the French Government to the Peishwa, subsequently given to the Thakoor. The English mail had reached Bombay just as I left, bringing tidings of the tremendous battle of Balaklava, and as conversation slackened I thought this would be news, and noticed it: the fact of the arrival of the mail was important—the battle of no account, and I was immediately asked the price of cotton. Flowers and rosewater having gone the customary round, I was informed that a gift was intended me, and asked aside what I should prefer. My reply was, that I made it a rule never to accept a gift beyond a flower or tray of fruit: I was unable to return them adequately, and wished no more than a token of regard, of sufficient value as indicating friendship without requiring to be of price. This answer I was told would offend: so amongst a multitude of things enumerated I named a ring, and immediately had a beautiful emerald put on my finger. I asked permission to send a microscope in return,—a very poor exchange certainly—and did so on reaching Bombay by a friend who shewed how to use it. The Parsee philosopher was obviously skilful enough to keep it in order. Two singing girls then made their appearance, and gave us a wild plaintive air of which I could only make out the ever-returning phrase—"for I am a poor stranger."

The interview lasted about an hour, and we retired as we came. I had heard well of the Thakoor and his ministers before; as I went on I everywhere found the government praised in the highest terms, and the Carbary himself spoken of as one of the ablest, most upright, and far-seeing men on this side of India. The Court itself had long been simple in its customs and correct and moral in its character, and all these were fully borne out by whatever I could observe. Yet amidst a vast quantity of natural shrewdness and ability it did seem strange that a party of enlightened men, with free revenues of some £80,000 a-year, should have been for half a century on terms of cordial intercourse with the English, and remained in the singularly primitive state in which I found them. The treatment they have of late re-

ceived at our hands has not been such as to make them much in love with us, and like "the country mouse," they prefer their present state of untrammelled simplicity to our more perfect system of systematic supervision and dependance.

Jan. 5.—We started for Wullee about 11, attended by a couple of horsemen whom the Thakoor said we should find convenient as guides, and in truth very smart serviceable men we found them. The tide flows up the river about ten miles, and light vessels make their way occasionally to near Wullee. The country round Bhownuggur is rocky and sterile : by and by the rock disappears, and the land seems but little, in some cases scarcely at all, above high water ; it appears occasionally to have been covered by very high tides, and is for the most part salt : further on matters improve and cultivation makes its appearance.

We passed several water-courses from 15 to 50 yards across, obviously the channels of considerable streams during the rains. They were even now occupied by very respectable streamlets of the purest and most beautiful water. These occasionally changed themselves for 100 yards or more into very picturesque pools occupying the entire nulla. It was here we first met specimens of the pelican and of the noble and magnificent blue cranes of Goozerat. The Sarhus, or Cyrus as it is commonly pronounced, is a superb looking creature from four to six feet high, the body is pale, the wings darkish blue, the sides of the head and the gullet and upper portion of the neck bright red. They are always to be seen in pairs stalking majestically by the side of a river, marsh or pool, or sailing low in the air—the male somewhat ahead of the female—with their great flagging wings beating time. They have a sort of whistle or call when flying, that of the one being somewhat higher than the other. They are not at all shy, and suffer themselves to be approached quite close as if dreading no harm. They are considered models of domestic affection : if the one is killed or dies the other pines away alone, refusing to be comforted, and speedily following its mate. Along with these there was generally a white and often a blue crane about the size of the common heron of Europe, and both intensely pure and beautiful in tint. A group of them by the river side formed as picturesque a spectacle as well could be. I am not certain that I am correct in assuming a bird with a long beak, large body, and short legs, as a pelican ; it looked like one, but I could not get near enough to ascertain the fact.

I stopped for a couple of hours at the large village of Napoora.*—Here the villagers flocked round us and examined the instruments I had set out for

* Barometer here at 3 30—30.09; Thermometer 78°. At Bhownuggur 9.30 A. M., same day 30 041.

use; they were delighted and astonished at seeing me set fire to some gunpowder with a pocket magnifier, and from the deep interest taken here, as at most of the other places at which we stopped in all such matters as these, it seemed to me a hint might be taken by our educationists in endeavouring to open the mind through the eye, and awaken a thirst for knowledge by exhibition and experiment. A school inspector travelling with a collection of the simplest forms of apparatus with a few pictures and models, the use of which should be explained by him as he went, might convert each village schoolmaster into an instructor in physics, and while the young were taught such elementary knowledge as their circumstances and position admitted, curiosity and interest might be excited in the minds of all, the spirit of enquiry be awakened in some, and not a little knowledge imparted to others, by appliances now universally resorted to in Europe, but as yet almost wholly ignored in India, where they might be made so infinitely more serviceable. A poor man lay in the corner of the rest-house under a severe paroxysm of fever when we arrived: this left him almost immediately afterwards when I gave him quinine, and left several doses to be taken afterwards. The poor fellow seemed very grateful, and I hope a simple harmless prescription would do him good. The natives are familiar with a large number of febrifuges, and take gladly anything very bitter in taste. I question if quinine had been met with before in these parts.

In walking through the village I observed a group of three or four men who stopped me respectfully, and took me to a handsome well-dressed good-looking woman, perhaps about twenty, the wife as I understood of one of them. They said something about her eyes, and I supposed they wished me to shew the telescope or magnifier with which the others had been amusing themselves. It speedily appeared that the poor thing was blind from gutta-serna: there was no sign of this in the external aspect of her eyes, but they obviously were sightless, and the expression of her countenance was that of quiet resigned melancholy, so often observable in the faces of those suffering from this terrible affliction. The people around her seemed to be of her own family: their conduct towards their suffering kinswoman was that of affection and respect. From seeing me give medicine to the fever patient, they took me for a doctor. I sincerely wished I had been so for their sakes, but could only shake my head and express my sympathy with their afflictions. The mother of a young family struck blind has always seemed to me one of the saddest and most mournful of spectacles.

"Knowledge by one entrance clean shut out"

of all that great domestic circle, how great and excellent to its centre, however circumscribed to the outside world it may appear.

The latter portion of this day's march was accomplished on foot or on horseback, the Thakoor's sowars lending us their steeds. The last eight miles of the journey, twenty-two in all, was performed in the dark. We passed between the conical hills which had formed the most prominent points in the distance throughout the afternoon, in dim twilight, and I was not enabled to ascertain the formation to which they belonged. I have given a drawing of them as seen from Wullee, taken with peculiar care, the relation of the base to the height being verified by the theodolite. The reasons for these precautions will presently appear. Along with my own sketch will be found one from Dr. Nicholson—the two being nearly as unlike as possible. We reached Wullee about nine o'clock, and after some difficulty made our way to the caravanserai,—in this case not a mere rest-house or travellers' bungalow, but a strong-walled enclosure to which all wayfarers of all descriptions resort. But before describing Wullee, I must give some account of the Geological features of the country around, the extraordinary peculiarities of which formed my principal motive for pursuing the present route.

Recent Undulations of the Surface of Goozerat and Sinde.—Until Sir C. Lyell collected, some thirty years ago, that wonderful congeries of facts which, until then, lay so scattered as to present no mass sufficiently solid for generalization, it had been supposed that, though the crust of the earth exhibited abundant signs of frequent upheavals and depressions, that those marvels had occurred at a date so remote that the powers and energies which occasioned them had long gone to sleep, and that from the commencement of the historical period the outer world had been in a state of comparative tranquillity and repose. The publication of "The Principles of Geology" at once shewed, that all the phenomena now observable on the face of the earth could be explained on laws now in force and operating over vast expanses of time, and somewhat more energetically than at present, and that operations now in progress required only to be long enough sustained, to give us explanations of results we were in the habit of ascribing to agencies no longer existing. Even after this the impression still remained strong and general, that it was only in volcanic countries that vibratory movements were frequently to be looked for, and that the crust of the earth was likely only to undulate or become broken up where there were vents of flame and smoke in the neighbourhood.

Of the soundness of Lyell's views and the fallaciousness of popular opinion, some parts of India—and especially Cutch and Goozerat—afforded conspicuous illustrations. Somewhere betwixt the year 1757 and 1772, coincidently probably either with the eruption of Pondicherry of the first, or the Chittagong

earthquake of the second date; the islands of Chedoobha and Ramree on the Arracan coast rose at once ten feet, having on two previous occasions, at intervals of about half a century from each other, made similar jumps upwards. In 1772 sixty square miles of the lowlands along the shores of Chittagong were submerged,* one mountain disappeared, another sunk down till its summit only remained visible. Cutch and Goozerat themselves had at a still more recent period been visited by catastrophes of a like kind on a still more extensive scale. On the 16th June 1819, at Luckput, the creek was deepened by 18 feet; the village of Sindree, during a frightful earthquake sunk beneath the waves, and nearly 2000 square miles of country near the eastern mouths of the Indus was permanently submerged. A vast ridge 60 miles in length and 16 across was raised to the altitude of 16 feet, and was called by the name of the Ulla Bund, or Mound of God. At an earlier date convulsions of the same description, but of much greater extent, are said to have been frequent betwixt the Indus and Gulf of Cambay. The Runn of Cutch covering as it now exists an area of 7000 square miles, overflowed during the monsoon, and presenting a level salt marsh or desert for the rest of the year, is believed to have at one time been much deeper and more extensive than at present, constituting a great bay or inland sea betwixt Sinde and Cutch: many of the places around its supposed former margin still bearing the names of seaports. A holy man who had been insulted by the inhabitants, is said to have curst the spot and rolled back the sea to its present bed: events all supposed to have occurred within our era. Around the whole of India is a marine formation forming a belt bordering the shore, consisting of gravel and recent sea shells, such as those still occupying the adjoining waters. These are sometimes loose, occasionally cemented into stone; lower down are not unfrequently beds of clay containing the roots of bushes still flourishing around. From the whole arrangements it is obvious, that this is the result of a depression and emergence of from 10 to 20 feet, both movements occurring at a comparatively recent period † This much premised, it will be understood with what intense interest I read the account given by Dr. Nicholson in the Journal of the Royal Asiatic Society of London for 1851, of the probable submergence of the ruined city of Balahbipoora close beside Wullee, and the eagerness with which I embraced the opportunity of examining the spot described.

According to Colonel Tod, "Balahbipoora was the capital of the ancient provinces of Mewar. It was said at one time to have been twenty-two miles

* See paper on the Volcanoes of India, Vol. xi. p. 147.

† See Transactions, 1850, Vol. x., p. 215.

in circumference, and that it contained eighty Jain temples. It was destroyed about the middle of the eighth century, and was supposed to have been submerged under the sea."

The catastrophe, it will be seen from the preceding remarks, was far from improbable: so much weight had been supposed to attach to it, and so great an interest taken in its existence, that the Court of Directors, on the suggestion I believe of their present chairman, Colonel Sykes, a man indefatigable in scientific pursuits, and who permits no opportunity to pass unimproved of extending the boundaries of human knowledge, directed the spot to be surveyed, and Mr Kinloch Forbes of the Civil Service was deputed by the Bombay Government to examine and report on the state of the country around Wullee: his answer I believe was, that he was unable to discover anything in anyway remarkable.

It appeared to me that a question which promised, if Dr. Nicholson's views were correct, to furnish us with an approximate date to a great Geological convulsion, ought not to be suffered to remain in a state of uncertainty, and accordingly I believe it to be now entirely set at rest, though in a way altogether opposed to Dr. Nicholson's views, and my own very strong prepossessions.

We reached Wullee, as already stated, about nine o'clock. The night was bitter cold, and our accommodation not a little comfortless. In the morning the introduction we brought from our Bhownuggur friends secured us all the attention that could be desired. About 10 we were waited upon by the principal men from the Thakoor, and conducted into his Highness's presence. The arrangements were similar to those at Bhownuggur, but on a very much inferior scale: the accounts we afterwards received were not by any means flattering to the administration at Wullee.

The town stands on a slight plateau about thirty feet or so above the plain, which stretches away to the creek of Bhownuggur here about a couple of miles off. The ground in this direction is tolerably fertile and well cultivated. I searched in every direction for vestiges of an old sea beach or terrace, but though much experienced in such enquiries long before quitting Europe, saw nothing which offered the slightest trace of change of level.* The town

* The Barometer at the Durumsala Wullee on our arrival at 9·30 January 5, was 29·813; Thermometer 76. Next morning 6 40 A. M.—29·902; Thermometer 54; At 9·30—29·902; Thermometer 78. The Bombay maxima for the 5th and 6th were 29·976 and 29·958 respectively. The Bhownuggur maximum of the previous day 29·937. This would give Wullee about 30 feet above Bhownuggur; but I attach little weight to Barometric altitudes where there are no means of direct comparison at points so distant, and with such slight difference of elevation. I estimated the plateau on which the town stands at 30 feet above the creek. This happens to agree with the mercury; had it been otherwise, I should have adhered to the non instrument estimate of depression.

looks squallid and poor, large pieces of unhewn stone (very dark sienite resembling large grained greenstone—not granite, as stated by Dr. Nicholson) are to be found in the foundations of many of the houses. These bear no marks of dressing or preparation, much less of sculpture; the largest I observed were about two feet cube. I had unfortunately passed the two conical hills described by Dr. Nicholson as the places whence these blocks were in all likelihood obtained, just after sunset, when there was not light or leisure sufficient to permit of their being examined with anything like care. I have given sketches of them as taken from Wullee. I checked the elevation and base by the theodolite, and can vouch for the accuracy of the representation. On the page following is a copy of the drawing of the same hills which accompanies Dr. Nicholson's paper, and it will be seen that no two representations of the same scene can well be more alike each other. The outline of the hills certainly is remarkable: they form detached members of a low range stretching towards the creek, but bear no more traces of vicinnage to the sea than any other isolated rocks springing rather suddenly from a somewhat even, but by no means level plain, on which I failed to discover the slightest indication of marine gravel or remains.

The Thakoor, the same Chief referred to by Dr. Nicholson, undertook to be our guide through the ruins. We commenced the search almost immediately beyond the gate of the town, where a considerable excavation has been made, in quest of bricks. We found ark and other bushes in abundance, with fragments of bricks scattered about. Here and there excavations were being made in quest of bricks for building.*

* It is but fair to Dr. Nicholson, now alas no more, to leave him to speak for himself. He was the first to direct attention to the Ruins of Bahlipoora, and collect together into one paper the scattered fragments of the information regarding it. His paper is most agreeably written; if his views be unsound they have the stamp of strong probability, and if many of his statements be highly colored and eminently inaccurate, as they most unquestionably are, they are picturesque and have been vouched for by distinguished authority. I took care to leave no room for doubt, and the paltry relics themselves remain as ground of judgment:—

"In travelling through the eastern part of the province of Kattiawar, and in that division of it called Gohelwar, after having traversed an extensive, perfectly level, and for the most part a desert plain, in a course from the north-west to the south-east, I found myself suddenly passing through a jungly tract of country, the vegetation of which, with the exception of gramina, was entirely composed of pilu bushes or trees, as they are named in the north-west of India—the *ark* of the Arabs (*Salvadora Persica* of Linnæus). The surface of the country through which my route had previously lain, was dotted here and there with a solitary tree of the *Acacia Arabica*, and consisted of a very deep alluvial soil, as evinced by the banks of several nalas and small river-courses, many of these containing a good volume of water; but from the almost complete level on which they run, all are very sluggish in their movements. Most of these streams, and also of the

No trace of sculpture, or of anything entitled to the name of architecture even in its widest acceptation, was discoverable anywhere. There was not the slightest sign of submergence or change of level: no trace of marine or aqueous remains. The relics told their own tale: the far-famed Balabhipura —if the mass of ruins near Wullee be supposed to represent it—might have been larger in size and more wealthy and populous than the wretched little hole built from its debris; but it could scarcely have been of greater elegance or architectural pretensions—of less it hardly could have been. When it became deserted and fell into decay,—why, it is vain to enquire, when it is remembered how many decayed cities have been lost sight of

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soil, are impregnated with salt, which in some parts covers the surface of the earth with an efflorescence like that of a strong hoar-frost. These streams all run to the eastward, to empty themselves into the gulf of Cambay; but, long ere reaching it, most of them are lost in the soft sandy soil in the vicinity of that arm of the sea.

"The jungle of pilu is of great extent, and the road runs through it for upwards of a mile, at a rough computation. This jungle now occupies the site of what was once a very large city. The surface is in some places strewn with the debris of red burnt bricks, that bear all the marks of having been composed of clay mixed with straw or grass, like the Hebrew task-made bricks of ancient Egypt, though the latter were only sun-dried."

"For nearly two years (for so long only have they been acquainted with the existence of these brick *mines*) have a considerable number of men been collecting and selling these bricks for building in the neighbouring villages and towns—some being shipped on the Karri, a branch from the gulf of Cambay, are carried to Bhownuggur, the capital of the country. As far as my examination went, the soil was unmixed with fossils, or even with the debris of the ruins it had buried.

"The broken bricks seen on the road must have formed part of some building of height which had not been submerged, and which the corroding hand of time had subsequently levelled, if it had not been done by the natives of Wallay to assist in building their town.

"I observed in the excavations, several floors of houses, paved with large yellow bricks, which remained on their primitive level, attesting that at least they had not been overthrown by any great convulsion of nature, though such an occurrence may have been the actual cause of their ruin; of which we have an example in the village of Sindri near the mouth of the Indus, which, after the great earthquake of 1819 (of which we have never yet had a satisfactory account, * and if there was no deeply hidden connection between the two, still it is curious to know that an earthquake took place at the same time in Mexico, and I believe also in Sumatra,) sunk down to a depth of twelve or fifteen feet, and was immediately submerged in a lake that now occupies its site, in the midst of which, not many years ago, parts of the walls were visible. If, in after times, a rising of the ground about Sindri should occur, or if the water of the lake should find an outlet, we should be furnished with a perfect resemblance in condition to the city we are treating of."

"The walls of the town of Wallay are in a great measure built of cyclopean blocks of granite, which, it is said, were removed from an ancient road or pier leading from Balabhipura to the karri or port. The thakur stated, that the karri

* I know scarcely any earthquake, the particulars of which have been so minutely and so often given by Captain M'Murdo, Colonel Grant, Sir A. Burnes, and Sir C. Lyell.

without our knowing anything as to the cause of their fall, long since Balabhipoora ceased to be—as building after building fell, the resulting inequalities became a trap for the drifting desert, and this again furnished soil for the mysterious trees found in abundance in much greater size all along the confines of the Runn, with which Dr. Nicholson was so greatly surprised. Were a similar fate to befal Bombay, twenty or thirty feet would be found to intervene betwixt the surface of the raised mound and the foundations of former structures, two or three times as much as intervenes betwixt the present surface and the lowest foundations of the remains of the ancient Balabhipura, and these in ten years time would be rounded over with dust and shaded with jungle.

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anciently was much nearer the city of Balabhipura than it is at present to its ruins, when a great trade was carried on here. This would tend to show that the gulf of Cambay is gradually being curtailed of its limits, a circumstance that accords with the views I had adopted after examining the breccia stratas of the Island of Perim, situated in that gulf, the result of which was communicated to, and published by, the Bombay Branch of the Royal Asiatic Society, in 1840, in their Transactions.

"The fact that the gulf is diminishing is also, I think, evinced by the extensive and evidently sea-deserted tracts of downs at Domus, near the mouth of the river Tapi or Tapti.

"On making inquiries of the thakur concerning the globular granite stone in the centre of the circular temple, he stated that there is a legend in his family, that some one of his ancestors, in the hope of finding treasure, had attempted to dig up the stone; but after a hard day's labour, on repairing to work in the morning, it was found that the stone had, during the night, sunk just as deep in the soil as it was before operations had been commenced against it. After several futile attempts, the peculiar deity or *genius loci* appeared to the covetous sinner during the night, and forbade him to pursue his useless and sacrilegious attempts; and, in consequence, the natives implicitly believe that no mortal efforts can remove this stone.

"There is also a legend concerning the destruction of the city, to the following effect:—'This country in ancient times was inhabited by a race of people quite distinct from the present natives, when a mendicant Brahman arrived at the gates, demanding food and lodging, which having been rudely denied to the holy man, he took a cup of water (though where he procured it this legend saith not,) dashed it against the walls, and at the same time uttering certain maledictions, he shook the dust from his feet and departed;'—shortly afterwards the whole city, together with its inhabitants, were swallowed up by an earthquake, or some other destructive convulsion of nature.*

"I now proceeded to Chumarwara in order to examine the quarries whence it is stated that Balabhipura had drawn her supplies. The heat was excessive, and I despatched a native to look for and to apprise me of the position of the quarries in the hills, whilst I rested at the foot; but on his return he reported that he had not found any such places. These singular-looking peaks, resembling islands rising out of the water, consist of a light-coloured granite. The lower part of the chief one, on which some portion of the village of Chumarwara is

* The legend is clearly a counterpart of that given by Burnes, as explaining the cause of the drying up of the Runn of Cutch.

I never remember to have been engaged in any enquiry where I felt such perfect confidence in the conclusions arrived at, these being in the most entire opposition to the assumptions with which I had started. The assumptions themselves being in perfect consonance with probability, only they were upset by a clear and uniformly developed series of facts,—there remaining not the slightest trace of a presumption on the opposite side saving this one only,—that Cutch and Kattiawar having, within the past eight or ten centuries, been subjected to many alterations of level, the submergence in relation of Wullee, had it been depressed and elevated, might have been one of them: only there was no evidence of the fact, and many very strong presumptions, from the appearances around, against it.

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built, on the north-east side consists of immense granite boulders, all more or less rounded off at the ends and sides into spheroids or oblong rollers, like rocks that have been long exposed to the action of water. Several smaller hills, all very rugged, and be ring in some places the columnar structure, are studded at some little distances around the principal hill; but the visible parts of these smaller ones are perfectly uncommected with the chief one, and the ground between them, from one hill to another, is as level as the surface of water; and that it has been thus formed by water there can exist no reasonable doubt, for from this point eastward the Runn or water-deserted desert extends to the gulf of Cambay, now several miles distant I had no means of ascertaining the height of these peaks, but should not think that the highest exceeded one hundred feet; though on this point I may have been much mistaken, and the mirage, which was in full force at the time, would not assist me in my conjecture.

"If there are really no quarries to be found on the exposed parts of these peaks, (but I do not put much dependance on the natives' assertions, it would lead us to infer that the catastrophe had been the result of a subsidence of the group of hills together with the adjacent country; water (most likely of the sea) had then filled up the space, and been the cause of all the appearances already described. But in this case how is the water to be got rid of, unless we take it for granted that there had been a subsequent subsidence of the gulf of Cambay? That this has in reality either been the case, or that the bed of this gulf must at one time have been upheaved the existence of the Island of Perim attests. For a moment assuming the latter theory to be correct, we can easily imagine that the bed of a large sea being suddenly elevated, the water would overflow the neighbouring country, which was nearly on a level with its surface before the commotion took place. The water would then remain over its new quiescent till time and the action of the water had deepened its obstructed bed. And this theory derives some support from the fact that several of the strata composing the Island of Perim have been washed away from around it, which at one time must have formed the bottom of the gulf, and the remains of these strata, forming the island, are high above the water, as can be ascertained at once by a look at the section of that island."—*Journal of the Royal Asiatic Society*, 1851, p. 153.

The drawings of the Churnawarra Hills furnish instances of Dr. Nicholson's inexactness. As explained in the text, I have not the means of examining the hilly islands and blocks in and around Wullee, assumed to have been obtained from them, they have the forms of slightly columnar plutonic or volcanic rock with nothing whatever to shew, whether it has been by the water or the weather that they have been abraded. Nobody doubts that the land all around has risen and descended: what we want to know is, when? There is no evidence whatever that the Gulf of Cambay is filling up. The re-

The Thakoor and his followers, as already said, accompanied us all over the ruins for a distance of three miles, and though two hours investigation was certainly not at all sufficient for such a field of enquiry, the facts were all so consistent and uniform, and so utterly subversive of the theory—the truth of which was meant to be enquired into, that I know not that much more could have been learnt had we expended weeks or months in place of hours in our researches. Our friends were wonderfully struck, as usual, with the disclosures of the pocket Magnifier, especially with its application as a burning glass to fire a matchlock. The mysteries of the Barometer were beyond them—the Thermometer they partially understood. The Compass and

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cent movements seem to have no apparent connection with the stratification, either at Perim, or Domus, of much earlier date. Dr. Nicholson's paper was, as he informed me, in reality prepared for the Bombay Society somewhere about 1846, at a time when the doctrines of frequent change of level at a comparatively recent geological date, were only beginning to find acceptance. It somehow unfortunately was never printed in our Bombay Transactions, by the time that it did appear, many new facts had become known and doctrines were broached not then before the world, and of which the writer, had they been within his reach, would in all likelihood have availed himself:—

"The extreme antiquity of these ruins I think is proved, perhaps not so much from the depth of the superincumbent soil which has overwhelmed them (for this might be the work of a very short period of time) as from the enormous size of the very slow growing *Salvadora Persica* flourishing upon it; from the art of making such excellent bricks of a mixture of straw and clay (for on breaking a fragment of one of them, a great many tubular cavities are seen, running in all directions through its substance); and from the use of these bricks to pave the floors in their houses, so totally at variance with the knowledge and customs of the present race of Hindus, whose habits we have been accustomed to consider as less changeable than the laws of the Medes and Persians. These points indicate the antiquity of the ruins more than the cyclopean dimensions and the fine workmanship of the granite monuments, for we can with accuracy, I believe, date the time when similar works of art were produced in other parts of India.

"When the bricks are first dug out of the soil, they are saturated with moisture, and are softish, but on being exposed to the sun, resume their pristine hardness. The yellow bricks appear to be softer than the red ones, and it is probable the former had been burnt in straw, whilst the latter had been baked in cow-dung or wood fires."—*Ibid.* p. 152.

The Bricks so far from being excellent, are execrable:—I say so as a brick-maker. They are 14×7 inches or $8 \times 1\frac{1}{2} = 2$ and $2\frac{1}{2}$, about the size and form of those presently manufactured at Surat. The clay has been slightly wetted and fashioned upon the rough irregular ground into bricks, when it was formed without any attempt at mixing or tempering. The brick boxes themselves must have been very irregular in their forms. The upper surface has been overwet and badly smoothed—the lower one is rough and irregular to the last degree and full of cracks. In place of there being any proof of the bricks having been burnt in kilns or by different kinds of fuel, the likelihood is, that they were dealt with after the Surat or Kurrachee fashion—built up in long trenches and mixed with dung dead carcases, bones, wood, or anything combustible that presented itself: the difference of aspect depending on the part of the kiln from which they were drawn.

Telescope of the Theodolite were the chief marvels; but when I shewed them that the angle of elevation or of azimuth altered as we changed our position in reference to the object observed, then drew a very large diagram on the sands, they seemed to have some general dream as to how this might come to indicate magnitude and distance,—a dream which I have generally found capable of being matured into reality, even with the least informed, with a moderate expenditure of time and patience.

Having taken leave of our very attentive and well-intentioned friends, we continued our way through the jungle, searching everywhere as we went, but without results, for something bearing on the submergence theory, or some tangible proof indicative of the age or splendour of Balabhipoora; but all was darkness, as to whether the celebrated city bearing the name supposed attributable to the ruins on which we now stood, lay mouldering under our feet, or whether any city of such name and renown ever existed. There is nothing in the three or four square miles of crumbling bricks near Wullee affording any indication of more than a somewhat extensive, slovenly, and ill-built town.*

It is needless to continue this portion of my notes in the form of a journal: it is enough to state, that from Wullee I proceeded towards Wudwan, the principal town in the province which bears that name. The distance is about 68 miles or thereby, and this was accomplished in three,—or more correctly speaking, in part of four—days. We left Wullee about 11 o'clock on the 6th, and reached Wudwan about the same hour on the 9th, dropping the morning march of the first day, and taking it up on what was meant to have been a day of rest on the 10th.

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* The following is a list of the places passed, with the distances betwixt each, as taken in part from the large lithographed map of Kattiawar, in part from computation or information received on the spot:—

1855.—4 P. M.—Gogo to Bhownuggur—12 miles.

5 „ —Bhownuggur to Wullee 24; villages Puchegaum—Kunthaloo—Hurmutheca—Kunthaloo—Hurmutheca—Nusserpoor—Lackery—Wullee.

6 „ —Wullee to Rampoor, 24 miles—Careanee—Veigelee—Kullanghur Sassaria—Briggar—Vavree—Konkunnee—Rampoor.

Jan 7 „ —Rampoor to Kharroo, 24 miles. Auccally—Vennipoor—Choora—Bhuljana Kurwa.

8 „ Kurwa to Wudwan, 6 miles. No villages.

The following is an extract from a paper by Dr. Bird on Bactrian and Malli Coins, published in the Journal of the Bombay Asiatic Society, 1843. If Balabhipoora, the ruins of which are now found near Wullee, really existed in the fourth century, the condition in which they now exist proves a doctrine precisely the opposite of that enunciated by Dr. Nicholson, and shows that, for the past 1,400 years at all events, there has been no such change on the surface of the portion of Kattiawar as to lay under water ground now 30 feet and upwards above the level of the sea.

"This prince was cotemporary with Siladytia I. of Goojerat, who lived about

Our line of march,—for there is no regular thoroughfare, but over a series of unformed paths from village to village,—lay nearly parallel to the eastern Runn, as it is called, a long, shallow, rocky channel, or dried up estuary, extending from near the mouth of the Suburmuttee at the upper end of the Gulf of Cambay for about 100 miles northwesterly. The lower part of it is partially occupied by marine silt; with a high tide and southerly wind during the rainy season, it is occasionally innundated by the sea. The upper end is, for eight months annually, dry and filled with strong grass and reeds. It everywhere abounds in salt, and is obviously an inland sea-creek elevated at no very distant date 8 or 10 feet above its former level, and rendered dry by some of the great terrestrial movements so frequent in these parts,—most probably the same which raised the bed of the Western Runn—or as the Natives have it, rolled back the sea from its former channel. The ground is very low and even on both sides, and for a considerable distance charged with salt, which, drawn up by capillarity, makes its appearance as an efflorescnce after every shower of rain. The country along which we travelled is slightly undulating—nowhere a dead flat; but from the time I quitted Wullee until reaching Ahmedabad nowhere, even on the extremest verge of the horizon, was anything deserving the name of a Hill to be seen. The soil consists of a mixture of fine brown clay and small portions of gravel: at first the debris of traps exclusively, afterwards of a tertiary sandstone. It is fertile and easily cultivated where water is applied, but is almost wholly devoid of all traces of vegetation at this season of the year, unless where under the hands of the husbandman. In want of rocks or gravel, and in absence of all the usual geological tests, I took carefully selected specimens of the sand of every stream or brook we passed. For the first 50 miles this was perfectly uniform,

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A D. 270—80;* previous to whose reign the Sakas, or Indo-Scythian tribes, had spread their power and influence throughout western India; and soon after founded the city *Valabhipura* in Gujerat, which gives name to a particular era commencing A.D. 319. According to the authority of the *Raja Taringini*, the ruler of *Ujain* in Malwa about this time was *Srimon Hersha Vikramaditya*, the same as *Shapur* II. of Persia, who appears to have possessed himself of Sejistan, and other parts of Indo-Scythia, while part of Western India bore him allegiance under the authority of his satraps. Gibbon,† on the authority of Theodoret, states, that the united forces of Persia and India were present while this Shapur

* This date is inferred from the copperplate grants of land, written in the Cave character of the Sanskrit language, and obtained from Gujerat, which will be found on page 477, Vol. IV. for 1835 of the Bengal Asiatic Society, and Vol VII. of the same work, page 966. The latter is plainy dated 365 Samvat or Vikramditya era A. D. 309, but Mr. Wathen, who translated the former, mistook the date of it for 9 of the Valabhi era, whereas it is dated, agreeably to the custom of the Balhara emperors of India, in the 52 year of the kings individual reign, or Sridhara Sena who was the predecessor of Siladitya I.

† Gibbon's Roman History. Vol. III. p. 133. In addition to Gibbon's authority, the Dissertatio de Syris Nestorianis, in parte secunda Bibliothecæ Orientalis, page LV. may be consulted

—consisting of small rounded particles of trap, in general little bigger than mustard seed, with the ordinary amigdaloidal minerals, siliceous spar, agate, chalcedony, &c.*

As we proceed northwards, the soil becomes siliceous, and this sent me on the hunt for rock, which I first met near Wudwan. It had here been excavated to a considerable extent as a building stone. It consists of a yellowish white, greyish white, or pale red siliceous grit, arranged in thick and nearly horizontal beds. It is not unlike some of the lower members of the coal formation, or upper ones of the old red sandstone,—although I have no reason to assign it to either division of rocks. It scratches glass ; the portions of silex are bright and lustrous under a moderate magnifier. The only trace of organic remains I could discover was a petrifaction, apparently of a Palmyra root, converted into jasper, similar to that from near Ellichpore in the Nizam's dominions, and is not unlikely to correspond in age with the bone beds of the Nerbudda, in the Sewaliks, or Assam : all this being pure conjecture. In mineral characters it is much the same as that from which the finer buildings of Dolka and Ahmedabad are constructed. I found afterwards a number of pieces of stone closely resembling the silicified wood of Egypt : had I been able to verify this, I should have entertained no doubt that the Wudwan rock was a member of the Perim series ; but on narrower examination, the vessicular woody structure was awanting, nor was the external appearance sufficiently marked to be relied upon. I think it probable that to this class both this and the Ellichpoor rock belong, but do not feel warranted in offering a positive opinion. Close beside every village which we passed we found a fine large pool or lake of exceedingly pure water, and as it was obvious that this was helped by art, the first assumption was,—that it was the tank constructed by the people for the use of the village. A very little examination proved that this was precisely the reverse of fact, and that in place of every village having made its tank, every tank had brought a village into existence in its neighbourhood.

besieged Nisibis A. D. 337, during the reign of Constantius ; and that the King was obliged to relinquish the siege, and march for the banks of the Oxus, as the Scythian tribes in the neighbourhood of Kabul had invaded the northern part of his kingdom."

* I strongly recommend to the traveller the examination of sand and gravel whenever it can be met with, as often furnishing information of great value not otherwise available. He should be particularly careful to look out for portions of nodular kunkur, or calcareous limestone. These often contain fragments of shells, bones, or portions of crustaceans or marine animals, and indicate the formation of the clay from which they have been derived, when remains not so preserved have disappeared.

And here opened up a new field of speculation, to me of pre-eminent interest. I had just laid before the Society a paper on the subject of lakes and seas of no discharge—supposing that these were few in number and far removed from each other, and their peculiar economy due to the earliest ages of Geological history.* Here I found myself in a whole district of them, with all their history written and phenomena explained on them. Drawings of several of these have been given: they are types of all the rest. The lake or pool is for the most part somewhat retort-shaped, or of the form of the section of a Jargonell pear. It is from 300 to 800 yards in length, and from 100 to 300 across at the widest part. The basin of the lake has obviously been from the first a natural hollow, in which water accumulated during the rains, and probably remained for the greater part or whole of the year; at the side, where the lip of the basin was lowest, a rough mound of earth has been raised,—this to all appearance consisting of the scourings of the lake itself. So far as I could judge, it seemed at some former time to have been the custom to assemble the people annually to clear the dam, and to throw up the clearings on the lower edge in the form of a mound, gaining every year the double benefit of deepening the basin and elevating the spill-water.

So far as I could estimate from appearances, and so far as the rain gauges at Rajkote, Ahmedabad, Broach, and Baroda are to be trusted, I should guess the fall over the Runn district from Bhownuggur to Wudwan at about 25 inches, and it is quite clear it never descends in torrents.†

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* See Transactions, vol. xii, 1854-56, p. vii.—xix.

† The following newspaper accounts of the time give particulars of one of the most wonderful falls of rain on record. I am not aware where the Kattiawar water-shed occurs: a discharge of this sort ought to have covered the country with cataracts and ravines. Of these there is not the slightest trace within the districts I traversed. No man can travel a foot in India without lamenting that so little store should be set on observation—so few stimulants held out for enquiry by the authorities, who are not the less constantly lamenting the want of information, for the absence of which they are themselves exclusively to blame. There is not a province within the empire that might not create a reputation—were the talent abounding in the services stimulated or taken advantage of:—

"RAJKOTE, 31st July.—Storm in Kattywar.—I forward an account of a late heavy fall of rain at Rajkote, which may prove interesting to your readers. On the 26th July we had steady rain, four inches having fallen in the twenty-four hours ending on Saturday, July 27, at 6 A. M. The fall during the succeeding day and night was as follows:—

Out of betwixt twenty and thirty of these lakelets which I examined, in no single instance could I find the trace of a groove of exit or marks of an overflow. In scarcely one-half is there any appearance of a channel of supply, though all seem mainly fed from the narrow angular extremity which sometimes extends itself into a definite water-course always into a hollow. It is here alone that vegetation is to be met with,—a few rank marsh weeds and rushes, mostly grasses where waterfowl mostly prevail. Beyond this, most singularly as it appeared to me, not one atom of vegetation of any description is to be seen anywhere around the margin where land and water meet.

The basin slopes in pretty rapidly, at a gradient probably of one in ten: the water seldom seems to be more than 10 feet at the deepest, or to rise above this from 6 to 8 feet above the level at which we found it. The rainy season depth may thus be about 16 feet, its maximum area is certainly not more than one-tenth greater in the rains than during the fair season.

These pools seem to be devoted entirely to the purposes of people washing and for the use of cattle, nowhere could I observe a moat Persian wheel or other means of drawing water immediately adjoining them. There are, however, always numbers of wells a few scores or hundreds of yards off for the purposes of culture drawn by moat or wheel; and wherever the ground is tilled and watered it gives ample evidence of fertility, tillage being obviously quite as essential as irrigation.

The villages for the most part stand on slight elevations a few feet above the adjoining country. I could not discover whether this was due to art or

July 27, 1850.—From	6 A. M.	to 10 A. M.	Inches	5·83
...	10 A. M.	to Noon...	...	0·48
...	Noon	to 2 30 P. M.	...	1·67
...	2·30 P. M.	to 4 P. M.	...	6·17*
...	4 P. M.	to 5 P. M.	...	2·26
...	5 P. M.	to 6 P. M.	...	0·73
...	6 P. M.	to 8 P. M.	...	2 90
...	8 P. M.	to 10 P. M.	...	2·70
...	10 P. M.	to 12 P. M.	...	.....†
July 28th, ...	12 P. M.	to 5 P. M.	...	3 50
...	5 A. M.	to 6 A. M.	...	0·68
				26 02
Probable loss by overflowing and upsetting of bottle.....				2·00
			Total Inches.....	28·00

* Bottle overflowed. † Bottle upset.

In the following twenty-four hours from 28th, 6th A. M. to 29th, 6th A. M., three more inches fell, making a total from the morning of the 26 h to the morning of the 29 h of about 35 inches. During the day and night of the 27th the wind blew with great violence, generally from the south, but occasionally veering round to the

nature. There are commonly fine clumps of trees around the lake or near the village, many of them aged in appearance but of no great size.

The rationale of this, to me most surprising state of things, is by no means difficult. The evaporation over these districts, judging by that at Bombay, Kurrachee, Aden, and other parts where the fact has been carefully determined, amounts for the year probably to 80 inches, and does not intermit even during the rainy season, excepting in periods of actual fall, the rain being in all less than one-third of this. The fall seems so gentle while it lasts as to cover the country with a general suffusion of moisture, which sinks rapidly into the soil and accumulates in hollows without occasioning torrents or maintaining rivers; it leisurely finds its way to the lower levels, and in part ultimately to the sea, filling the hollows which it passes and maintaining them full. So soon as the soil gets dry to the depth of a few inches, from the bad conducting power of the earth, evaporation and capillary action cease, and the moisture underneath continues to pervade the lower strata till drawn off by the roots of plants, tapped by wells, or attracted by

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S. W. W., and as far as N. W.; and during the whole time there was thunder and lightning, but of no great severity. As might be expected, this heavy rain has occasioned considerable loss of property, the mud huts of this district being little capable of withstanding so severe a storm. The bridge connecting the camp and town has been partly washed away, and one of the round bastions of the town wall has fallen;—but I have not heard of any loss of human life or severe accidents, though the bed of the river on its subsiding was studded with the bodies of drowned cattle. Many trees have been blown down in camp, where they could ill be spared, and many outhouses have fallen in. The cavalry lines have suffered most severely, nearly half of the huts having fallen, this part of camp in appearance much resembling some of the sketches of Irish desolation which have lately appeared in the *Illustrated London News*.

As a means of comparison, the total fall of rain at Rajkote during the monsoon of 1850, that of

1843	was	27·56 Inches.
1844		22·13
1845		12·19
1846		31·15
1847		21 01
1848		24 21
1849		63 10
		7)201·05
Inches.....		23·31 average of seven years.

From which it will be seen, that the fall on the 27th July alone was equal to the average total fall of the whole monsoon of the preceding years. To place this heavy fall in a more striking point of view I may add, that the average total annual fall of rain is—

masses of liquid water.* The whole phenomena are meteorological, and must present themselves where rain falls leisurely and in moderate quantity, and the evaporation throughout the year is materially in excess of the fall.

The wells along our route varied from 12 to 46 feet in depth; the water was almost everywhere hotter—not only than the hottest part of the day or mean temperature of the winter season,—but than that apparently of the year. We have no data on which the slightest reliance can be placed for ascertaining what these actually are, and can only venture on a guess from the Bombay observations. These give the means for May and June at 85° for January, and February at 76°, as ascertained by hourly observation, or 80 for the whole year. As the northeastern part of Kattiawar is from three to four degrees to the northward, the mean temperature can scarcely be supposed higher than 77° or 78°, and as the range is very much greater, we shall not perhaps be materially out if we assume 68° as the winter, and 82° as the summer heat. The temperature of a very large number of wells varied from 80° to 83°—the singularity being, that it not unfrequently happened that of two wells of nearly equal depth within a few scores of yards of each other, one might be 81° or 82°—the other 76° or 78°.

I had no means of testing the Bombay springs at the same date, but the cold seasons of 1855-56 differed little from each other and were in no way remarkable. The comparison of both may be considered relevant, the result will be found at the conclusion of the paper.

I did not subject the water of the wells to any test: they tasted sweet and pleasant. Nearly the whole wells in the presidency have been analysed by

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At Paris	.....	20 inches.
London	.....	25 ,,
Geneva	.....	30 ,,

The total fall of rain at Rajkote this year, up to the present day, has been 47½ inches.—R. K.

* The reader will find a very interesting account of the singular cold of the wells around Peshawur in the Ninth number of our Transactions, 1849-50, p. 21, by D. Malcolmson: the water of the wells continues uniformly at 58; Peshawur is 34 N., and 1,000 feet above the level of the sea. If we suppose the mean temperature of the year to be in both cases indicated by the wells, we still have two places only ten degrees distant from each other—meridionally differing by 22 degrees in mean temperature—something unprecedented in Climatology.

In the published extracts from the Government Records, No. xii, 1855, the temperature of Sadra is given as follows:—

	Max.	Min.	Mean.
1851.....	90	75	82
1852.....	91	72	81
1853.....	93	72	82

Dr. Giraud, and no mineral property found attaching to any of those I have described. I have no hesitation in considering them all hot wells in the true acceptation of the term, and nothing surprised me more than to find some of the hottest of them in the gardens of staff officers or of medical men, but which had never once attracted their attention – steaming and smoking hot as they were every morning.

In some of the cold mornings, with the thermometer below 50°, they might be seen with little clouds of vapour over them half a mile away and all along the channels leading to the fields and gardens, and felt tepid and agreeable for the performance of morning ablutions.*

While endeavouring to ascertain something of the level of the surface by the Barometer, I found myself to all appearance rising much more rapidly than I could have imagined from the aspect of the country here sloping with the utmost gentleness. The circumstance arose from a storm passing to the northward and another to the southward, and which, though nowhere, so far as I could discover, manifesting themselves within a hundred miles otherwise, threw down the mercury by a couple of tenths of an inch.†

RAJPOOR—twenty miles from Wullee, is remarkable for the ruins of a fine old castle and several temples of some note. The town itself is a paltry one. The castle, and Collector's bungalow adjoining, stood over the point of a picturesque promontory formed by the junction of two considerable streams,

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At Cutch Bhooj the return is as follows :—

Mean for the year.		Mean for the year.	
1848.....	84	1851.....	94
1849.....	96	1852	94
1850.....	94	1853.....	94

I have omitted the fractional parts. If these returns be correct,—but I attach scarcely any weight to them—the wonder of the hot wells ceases : they are in reality a good deal lower than the mean temperature of the place, but in this case we have the anomaly of an isotherm leading from the line where the African mean temperature is only 83° the Sadia 24 hot. I can discover no place on the earth's surface noticed by geographers with a mean temperature above 70°.

* Nearly all the observations were made by my own hand, and I can quite vouch for their accuracy : those taken by Dinshaw are as much to be relied on as my own.

† It will be seen from page 27 note, that at Bhow nuggur the mercury stood at 30·026, at Wullee at 29·937 ; by 4 P. M. the same day it had fallen to 29·620. If the descent due to afternoon tide of say one-tenth, be taken into account by upwards of three-tenths—as it fell at Bombay about a tenth at the same, the other tenth, is probably due to ascent of the country, allowing say an elevation of 120 feet. At Rajpore again, at 6·30 A. M. it stood at 29·942, corrected for temperature at 54,—this being higher than it was at the same day and hour at Bombay, where the morning maximum was 29·910.

even in January tolerably supplied with water, and every here and there expanding into fine pools. Groups of large finely-formed trees, at this time in full foliage, are sprinkled around, and the scene, beautiful in itself, became peculiarly striking from the contrast it presented to the arid country just before traversed.

The castle itself very much resembles many of those to be met with in the Lowlands of Scotland, built when walls and outworks could not be dispensed with, but without the compactness, solidity and strength to be seen in our strongest keeps, indicating the extreme insecurity of property and disorder of the country. It contains a spacious outer and inner court, each surrounded by a strong curtain wall forming in part the outer wall of the buildings, which consist of two courts, now in a state of ruin. There have been massy round towers at the corners and overhanging turrets on the battlements. The outer court from gate to gate is 80 feet and 277 across. The inner court 277 by 220 feet. The gates are 20 feet wide, the walls of fine stone masonry from 3 to 4 feet thick; the cement is as hard and firm as the stone. The wall of the building overhanging the river measures 50 feet from the surface of the water to a fine stone gallery just under the battlements. Of the history of the buildings I could learn nothing, but it looks as if it might have been occupied within these 20 or 30 years.*

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* For the subjoined Translations I am indebted to the Persian Secretary to Government, my friend Mr. Venkyek Wassedew, who visited the spot in the train of the Governor in January, 1835. From the style of the architecture it is quite clear that the existing ruin, which seems never to have been completed, is no part of the building of 1645: to all appearance the present edifice scarcely dates a century back.

TRANSLATION of an Inscription on a piece of marble which is in the possession of the Village Officers of Ranpoor, and which is said to have come off the wall of the Fort of Ranpoor. (Printed *Rajpoor* by mistake, previous page.)

He is the Creator and the Omniscient.

Azum Khan,* a great Khan of the time; Prime (a new married bride) has not given birth to such a Khan; a fierce lion, a brave hero of the time; a Sirdar of the world, and a Khan of great dignity, (may God prolong his life) directed me with particular kindness to write the date of this Fort if I could. For the date of the erection of this building (may God secure it from the influence of the malignant eye), I asked assistance from the Creator, became a swimmer in the sea of thought by (his) order, (and) wrote on the ring-stone of my heart "*Azmabad*" (a great city).

* This is the gentleman who erected the Fort. He is said to have been an Officer of the Mogul Emperor.

We reached Wudwan on the morning of the 9th. The first indication of our approach to it being the appearance of half a dozen white-topped tents peering above the sand hills, and then a salute of sixteen guns, fired with a precision and effect that did honor to the discipline of the Thakoor's artillery. As we approached the scene became singularly picturesque. Wudwan, a wretched town about three miles in circumference, exhibited its mass without manifesting its defects. The gates and towers facing us looked quite warlike and formidable. Just outside was a finely built and sculptured tank with an elegant roof supported on pillars; a little nearer lay a smooth pellucid lake about half a mile in length with fine trees all along the furthest margin; nearer still was a handsome little temple, and betwixt this and the lake the Political Agent's camp.*

The little sandy hills were crowded with people to the extent of some thousands. There were at one place three elephants with some hundred or two wild-looking horsemen with matchlock and shield. The escort of the Political Agent consisted of a party of Irregular horse. We observed two in

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In the month of Mohurrum 1048 Hjree (A. D. 1633-34.)

Note.—The Persian letters have a numerical value assigned to each, and the letters which form the word "ز zumebilad" give the figure 1048 (as shewn in the margin) as the Hijree year in which the fort was erected, or rather completed.

TRANSLATION of an Inscription in the Mosque in the ruined Fort of Ranpoor.

In the name of God, &c.

God said that as all the Mosque are for the Almighty, you should not pray to other beings in them except Him. There is no master of a mosque. What is given in charity cannot be reclaimed.

This was erected .....‡ after the great Khan Numgalee Shah Ibn Hutzulee the learned. During the time of Sultan Ahmed Shah, the son of Mahmood Shah, this stone was sent for God's sake, the master of both the worlds in the month of Rumzan 1060 Hijree (A. D. 1645-46.)

Vide the remark in the other paper.

†	Ulif	1
	Neen	70
	Zoyu	900
	Mem	40
	He	2
	Lam	30
	Ulif	1
	Dal	4
		1048

‡ Words illegible.

* Captain Burr was, to speak correctly, only Acting Political Agent; his principal, Colonel Lang, one of the ablest and most upright and indefatigable of public servants, was in Australia on sick leave. He returned to his duties in Jan. 1856.

especially gay costumes, one purple, the other scarlet, galloping full speed from hillock to hillock and looking narrowly around them. One of these made at length straight for our bullock cart so soon as our party became fairly disclosed. They had been sent out by Captain Barr who was aware of our approach, in quest of us, and guided us to his tents, where we were received by my old friend, whom I had not met for a dozen of years.

WUDWAN.—The capital of the Talook of that name is a large dirty ill-built walled town, said to be four miles in circumference and to contain 10,000 inhabitants.

Here the Thakoor and principal men reside. The surrounding wall is a very tolerable structure, built of a whitish yellow tertiary sandstone abounding all around. It is from 2 to 3 feet thick, and from 35 to 45 in height. The town is entered by five gates,—the two largest of these are handsome and comparatively recent structures. There is in both these cases an outer and an inner portal, with a court of considerable magnitude between them. In the wall adjoining the western gate there are relics and fragments of old sculptures, obviously belonging to some pre-existing fabric, but of which I could learn nothing The facades within the inner court of the eastern or principal gate are covered with decorations, not a little ambitious however little tasteful. The town itself is dirty and supremely ugly. It contains four or five Hindoo temples of no mark or likelihood whatever. There is one large and very finely built well just within the walls in the western end of the town. It is descended to by a long series of flights of steps, each flight with its landing place occupying a nearly square compartment 17 feet by 18 feet, the stairs descending 7½ feet perpendicularly at each flight, the portals to the descending steps forming the next lower landing places, are 7½ feet wide. Measured at the surface, the gallery leading to the front wall is in all 230 feet in length and 22 across. There is a handsome pyramidal structure at the surface level, 8 feet by 7, and 6 feet high, at each partition. From the top of the upper parapet to the bottom of the well is a distance of 40 feet. Most of the water near the surface is brackish, that in the large well is sulphurous. I asked one of Captain Barr's attendants to dip the silver portion of his sword-sheath into the water, and it would blacken. The man understood me and assented at once, but said it would take some time ; that all the women's bangles blackened when they stood long in the water. The thing was caused, he said, by a force which long ago took the town having poisoned the principal wells by throwing brimstone into them. The explanation was superfluous—the cause was plain. The well was overhung by trees which had polluted the water by shedding their leaves, when the decomposition, which

takes place when decayed vegetable matter and salts containing sulphuric acid meet, makes its appearance. The well only requires to be cleared out and the trees to be removed to set matters to rights. There is another well of the same form but of much lesser size just without the eastern gate, and which obviously draws its supplies by percolation from the lake. The temperatures of both wells were, at sunrise and 3 P. M. found to be 69° and 71°, the air being 54° and 75°—so that the water was the mean of the coldest and hottest hours.

The Thakoor and his chiefs made a visit of ceremony to Captain Barr on the day of our arrival. His Highness is a poor decrepid wretch who lives on opium, and required twice to stop to partake of the drug on his way. He has a very bad name both as ruler and man, and it seems sufficiently deplorable that the interests and welfare of some 20,000 people should depend on such an imbecile. The people around him looked eminently intelligent, and were well spoken of. Captain Barr told me that they had a native newspaper lithographed at Rajkote which they had endeavoured, as long as they could, to make as much as possible of the war in the Crimea, the natives holding Russia in great veneration. Latterly matters had gone so ill they were at a loss what to say. He cautioned me how I should answer the questions put to me, as they were far too shrewd not to see through excuses. As already stated, I had left Bombay just as the tidings of Balaclava (6th Nov.) had arrived. Immediately on the mere ceremonial of audience having been got over, I was surrounded by the most intelligent looking of the Thakoor's followers, who asked about the news from Europe,—not the state of the cotton market as at Bhownuggur, but of affairs in the Crimea; the chief himself sat trembling in terror before the Resident, expecting to have a rebuke in store for him, and took no interest in anything. I explained how our columns had left the neighbourhood of Sebastopol to meet the enemy on the Tchernaya; how there had been a tremendous fight, and our cavalry carried everything before them. This seemed all satisfactory enough. But the question was: did they not take Sebastopol before going out to meet the enemy? I said as majestically as I could, "No!—What would have been the use of that when they went out to thrash the Russians beyond, and drive them like chaff before them!" Then of course, said they, when they had beaten the enemy, they marched into Sebastopol on their return? I once more replied: "No: what was the use of marching into the town when they had gained such a victory beyond it!" The reply was obviously most unsatisfactory, and they said of course all that was very true, only as there seemed to be no longer any difficulty of marching into the town, it would have looked as well and been

more comfortable if our troops had occupied it after they had been so long kept outside. I confess I felt the shame of being found out in endeavouring to put a good face on matters, and Barr assured me all attempts at delusion were in vain amongst a people so acute, who, if they could not always quite make out the fact, fully understood the nature of an uncertainty.

A man who had, in 1853, gone home with two fine Kattiawar lions for the Zoological Gardens had just returned, and with a traveller's license told all sorts of wonderful romances of what he had seen. Russia was the great theme ; he knew all about it and its people, who were tremendous fellows. He said they all wondered at the Sahibs for the quantity of animal food they eat ; but the Russians could eat nothing whatever but raw flesh : the moment a piece of bread touched their lips they vomited.

Along this quarter of Kattiawar the Hindoo notions of the sacredness of life are carried out to their utmost rigour. We could neither get animal food nor even eggs on our journey from Gogo, and missed the cock-crow heralding the dawn : the people kept no fowls. The consequences were, cattle, sheep, and all other creatures are to be seen wandering about under all forms of disease and decrepitude, refused the kindness of a speedy death at the hand of man.* The country literally swarms with antelope and deer,

* The following notice of the habits of the people of Kattiawar in these matters is taken from some papers on the Plague of 1817-18, published in the Transactions of the *Bombay Medical and Physical Society*, Vol. I. for 1838 :—

"Before proceeding further, it seems necessary to take notice of some peculiarities of the people in this province, which, in my opinion, exert a powerful influence over the progress at least of this disease. *They are the only people whom I have seen in India who might properly be termed filthy.* Ablution, which from being sanctioned and enjoined by divine authority in every other place, is practised with all the diligence and scrupulosity of their other religious ceremonies, in Katywar—from what cause I know not, is almost wholly neglected. The evil consequences of this neglect are much increased by the enormous quantity of clothes which it is the fashion for all ranks to wear, and in most ranks these clothes are but seldom changed. In some of the inferior, it seems almost as if they were allowed to rot upon the persons of their owners without once being washed or even removed from their first being put on, till they can no longer serve the purpose of covering their nakedness. Another common practice in most parts of India, friction of the body with oil, which might in some measure have counteracted the evil consequences of the other neglect, is unfortunately here also in equal disuse. This very grateful and salutary practice, which by encouraging and at the same time modifying the process of perspiration, has so powerful an effect in regulating the temperature of the body, as well as in preserving the balance of the circulation, and by preventing cuticular absorption must prevent the admission of contagion into the system in that direction, has, upon very good authority and extensive experience, been supposed a complete preventive as well as a powerful agent in the cure of plague."

"In Kattywar, industry is unknown (in many places it is beginning however to revive,) and that chiefly in the districts where this disease has raged. Cultivation

the black buck being amongst the most abundant and beautiful. They browse by the wayside, or sweep along the fields quite within pistol range and unconscious of danger; and I have seldom felt myself conscious of a more cowardly act than in shooting a half-grown fawn and afterwards a fine buck, who suffered where they meant no harm and dreaded none. The magnificent Sambre, or Elk, often reaches the height of 5 feet from foot to shoulder, of nearly 8 to the crest, with a spread of antler of 6 or 7; and the Nielgye, or Blue-Ox, attains dimensions still more magnificent. There are hundreds of small sized hares and rabbits, with plover, bustards, florikin, black-partridges, and quail in abundance; there are three or four kinds of pigeon, five or six varieties of duck, teal, snipes, and I will hardly trust myself to say how many other forms of game.* Of course this state of matters only obtains in districts rarely visited by Europeans; where sportsmen make their appearance wild animals of all sorts keep beyond their reach. But for the natural checks the entire crops would be eaten up by these tolerated intruders, whose members, unless thinned out, would press upon the means of supply. The checks consist in multitudes of short-maned lions, tigers, leopards, and panthers, wolves, jackals and hyenas,—the first class disposing of the fresh provisions they kill, the second being content with carrion,—vultures, kites, and all the obscene birds which fatten on putridity close up the arrangement, and produce that balance in the powers of vitality and decay the hand of man refuses to redress.

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is almost neglected, and the inhabitants depend for the means of subsistence principally upon the milk and ghee furnished by their cattle. Partly from this cause, and partly from the strictness of their religious tenets, which rigidly forbid the death of any animal, every family has accumulated a large stock of cattle, and these, amounting to hundreds or thousands according to the size of a town, are invariably driven within the walls at sunset, and are penned for the night in the same house which contains the rest of the family. Thus no limits are set to the number of cattle accumulated in every family excepting by death the consequence of disease, or old age.

"Still all animals are doomed to die; and, notwithstanding the humanity of religious tenets, this forfeit must be paid in one way or other. In proportion, therefore, as we diminish the number of deaths by artificial or violent methods, we should naturally expect an increase to the number by natural causes; or, in other words, that disease and sickness would be multiplied. Accordingly we find this to be the case, the cattle of Kattywar afford the clearest proof of it; few seem altogether free from disease, and many are seen in the most wretched condition, crippled and crawling about with swelled legs and diseased skins."

* Dr. Gibson mentions the Adjutant and Flamingo as amongst the birds of Kattiawar; no better authority need be desired, though I am not conscious of having observed any specimen of either. I saw indeed only a small portion of the wild animals I have enumerated, and give the rest on other authorities.

I seldom remember to have spent three happier days than those on which I resided in the camp at Wudwan.

FROM WUDWAN TO THE NULL.—Jan. 11. We left Wudwan a couple of hours before daybreak, proposing to have an unusually long day's journey. The first portion of the route lay nearly at right angles to that which I had hitherto pursued across the upper end of the Eastern Runn, where I was anxious to visit a singular detached brackish lake, which had to all appearance originally formed the terminal portion of the Runn when that which is now a salt marsh was an estuary.* The Thermometer on leaving Wudwan at half past 4 A. M. was 58°—a temperature which makes a Bombay native shiver and look most uncomfortable. Fires had by this time begun to blaze near all the tents around—the people sitting so close to them that they looked crumpled, much more like as if they were being cooked, trussed up, motionless as they were, than warmed.

About 10 miles from Wudwan is the village of Seahore—by much the cleanest and most thriving looking we had hitherto met with. It was situated on a considerable plateau about 20 feet above the adjoining country. It was surrounded by a tolerably good low wall, with gates and turrets, and divided by moderately open and not very filthy streets. There were four or five huge hay stacks near the centre of the town, black and fearfully perforated by rats; they were stated to have been provided for the service of the Guzerat Irregular Horse, but seemed to have stood for many years neglected. Close under the walls of the town is a beautiful little lake, pretty nearly a mile in circumference, with a handsome small-sized mosque on its margin. Here was a neatly kept, well-enclosed native burying ground, the first in those parts I had seen. The grounds around seemed fertile and were well cultivated, the people appeared industrious and comfortable, presenting a wonderful contrast to all we had hitherto seen within the peninsula of Kattiawar. The general aspect and character of the country was pretty much the same as that of the districts we had hitherto passed. The lake referred to was of exactly the same description as all the pools of no-exit hitherto described—only a little larger, and no village was to be met with anywhere without one of these being found close at hand.

We reached Bavelee, close by the Null, late in the afternoon. It is one of the most dilapidated and miserable looking places we had yet seen. There is not the less a very fine little lakelet adjoining, and this is surrounded by handsome trees, amongst which far finer specimens of Ak than those des-

* The following are the towns and villages on the route from Wudwan to the Null :—Wudwan—Marmeoo—Khugailee Seahore—Foolwady—Rosasur—Bavlee—the village of the Null,—close on 24 miles in all.

cribed by Dr. Nicholson as surprising him at Balabhipoora and Wullee, are to be met.

The Null is a large lake of brackish water* extending over an area of about

* I have taken the facts and in part employed the words of Major Fulljames in describing the Null. My two hours' exploration—all the time I could command—allowed me only to verify his statements so far as I could observe. See paper on "The Null"—Journal of the Bombay Asiatic Society, 1853, No. xviii. vol v. p. 109.

I do not concur in the idea that there is any evidence of these depressions being due to any movement more recent than that affecting the Runn itself:—

"The Null is a large lake of brackish water 87 miles S.W. by W. from the city of Ahmedabad, and situated on the western frontier of the Dholka purgunna. It extends over a measured area of 31,560 acres, or 49½ square miles. Of this 22,796 acres, or 35½ square miles, were actually covered with water at the time its outline was surveyed in February 1824.

"In general character it is shallow, rarely exceeding 6 feet, and muddy in those parts which are free of weeds, but quite clear where these abound; thick, nearly impenetrable masses of bulrushes and high grass surround the western, south run, and northern shores of the lake for a considerable distance inland; the eastern shore is generally open and free of rushes. No perceptible bank appears, and the country that borders on it is a dreary, desolate flat, though in some places with a vegetation of the rankest and most unwholesome nature.

"On its eastern side there are some very remarkable undulations, which bear a remote similarity to the Mor Puna, or sandy hillocks that skirt the sea-shore between the Tapti and Nurbudda rivers. It is also worthy of remark that those undulations are composed, as far as I have been able to examine, of drift-sand; that they extend at considerable intervals from the eastern side of the Null in a *north-westerly and south-easterly* direction, as if thrown up by the action of the waves of the sea by a south west swell. Such sand ridges are to be met with near the western and southern base of Mount Abo.

"From the usual bearing of the ridges, and in the present absence of the sea, it may be inferred that the action of the south-west winds has assisted their formation, as the sea would have done, for these winds must blow during the monsoon with great violence over such an otherwise level country, the soil being in most places a loose, fine, reddish and whitish sand, easily acted upon by any wind that blows. Between the ridges are extensive bays, having a crust of salt on them, bare of all vegetation; in fact they resemble those bays to be seen along the coast which are inundated by each flood tide. They extend east as far as Jeytapoor, a distance of 8 miles."

"It is possible some of these undulations may have been formed in the first instance by some upheaving force from below, for we have abundant proof in many parts of the western portions of Guzerat, that they have at remote and recent periods been much disturbed by volcanic agency; the former is evident from faults in the sandstone rocks near Ahmednuggur, 60 miles north of Ahmedabad, and from the basaltic dykes which have been forced up through horizontal beds of these sandstone both in Kattywar and Cutch; a very good example of which is to be seen at the town of Than, 38 miles north-east of Rajcote. The formation is a reddish compact sandstone, the strata of which appear horizontal. Through these strata, a dyke of columnar basalt has been forced: the dyke is about 8 feet wide, and appears to have been forced vertically, though the columns lie horizontal like the strata of sandstone; a white calcareous cement appears at the divisions of the columns. The dyke crops out to the surface, and can be traced a considerable distance as forming the bund of the tank at Than. It strikes north and south. The people of Than have turned the dyke to good account in forming wells by extracting the basalt, which from its columnar formation is easily done, and leaving the

31,500 square acres, or close on fifty square miles. Its waters are shallow, rarely exceeding six feet at deepest; they are clear where weeds abound, and afford shelter from the wind, where exposed to the breeze the riplets are sufficient to disturb the mud. Around the south and west it is surrounded by a thick mass of reeds and gigantic grasses. The eastern and part of the northern shore presents a smooth light-colored, firm, gently sloping beach. The village of Bavlee on the western shore, affords an excellent view of the lake, as does that of Veckrea from the east. There is another singular hollow described by Major Fulljames, called the Boke, to the northward of Ahmedabad. This I have not seen; but with the fullest reliance on this able and indefatigable geographer—alas too early taken away.*—I cannot concur in his theory of their formation; these hollows seem all exactly *of* the same character as the lakelets abounding through the country,—with this difference, that the Null and Boke are larger in size, the former having at no distant period been cut off from the creek now called the Little Runn, which still abounds with salt, which a sufficient succession of rainy seasons will in all likelihood in course of time wash out of it.

FROM THE NULL ACROSS THE LITTLE RUNN TO DOLKA.—Having seen as much of the Null as I wished for, I next morning started before dawn for Dolka; and though quite confident, from the direction pursued, that the wrong route had been taken, the guides were so positive that we pushed on Having proceeded ten miles south-east, in place of north-east the proper direction, I now insisted on going towards Ahmedabad, when it *turned* out that there were two Dolkas one *in* Kattiawar on the hither side of the Little Runn, and the other in *Goozerat* beyond it; and it was *for* the *former* of these we had hitherto been making. The blunder was doubly provoking—first be-

sandstone on either side untouched. Apparently an abundant supply of good water from the sandstone is procured. The wells to a casual observer appear as if excavated from the sandstone rock, but a close examination shows the way they are made.

"I believe it is generally admitted that both the larger and smaller Runns were at one time covered with sea water, and they therefore must have been connected with the sea by either the Gulf of Cutch or the Luckput Channel, or more likely by both. It is also commonly believed that the depth of water was such as to enable boats to ply from one point to another. By an inspection of the country I am led to believe there was formerly a third direct connection with the sea by the Gulf of Cambay, and along the low salt country leading to the Null, and from thence to the Little Runn. If such was the case, the present Peninsula of Kattywar would then have been an island like Cutch."

* Major Fulljames died in the beginning of 1834, deeply and universally lamented, alike for his talents, his industry, his zeal, and personal good qualities

cause of the loss of time it occasioned, and second, because I was anxious to cross the Runn where it tailed out above the Null.

Having turned off at an acute angle to the track previously pursued, I shortly afterwards entered the Runn, and continued to toil through it for a distance of some seven miles, which it took three hours to accomplish. The road, if the term may be employed, is a mere cart track, which for half the year must be a nearly impassable swamp. The mud of which the surface consists was in January perfectly dry, but the wheel ruts were from 8 inches to 2 feet deep, and that the wheels did not sink to the axles altogether, was due to the roots of the reeds and gigantic grasses which form an impenetrable mass all around. We could not see the tops of the carts which followed us a hundred yards off. There was no landmark of any description to guide us: fortunately there were no cross or side roads to lead us astray. When we met with carts or camels, they required to get into the reed forest to let us pass. The air was stagnant and the heat oppressive, and the whole scene one of unspeakable desolation, and to me—and I should think to most—of the most perfect novelty. At length the grassy and reedy jungle began to become more feeble; the horizon expanded before us, and by and bye in the distance we could descry the tops of bright green tufts of trees. At length we emerged from this singular morass, and found villages of considerable beauty, in tolerable contiguity to each other, accompanied by the never absent lakelet and tufts of trees. There was still little change in the aspect of the country or soil. The roads, though just as Nature left them, were but little to be complained of, the climate being so dry, and the soil so liberally mixed with clay and sand, as to prevent the fearful ploughing up and the almost indescribable condition of things prevalent from Ahmedabad to Surat.*

JAN. 13TH. DOLKA.—Starting at dawn from one of the first large villages eastward of the Runn, we reached the ruined city of Dolka about noon—and a very noble one it must have been, complete as is the delapidation into which it has now fallen. The road takes a long sweep of nearly two miles as the town is approached, and I was under serious apprehensions we had missed our way and were going past it. At about this distance the plain is covered over with round curious looking mounds from 10 to 30 feet in elevation, as if indicative of ruins below. Water seems plentiful, and the ground is well

* The following were the villages we passed after leaving Bavlee on the Null—Puralee on the Runn—Pownalee beyond the Runn; Wuijee,—20 miles in all. Here we stopped for the night, being assured that we should find no quarters for a long way ahead. The Thermometer in the course of the night fell to 48°, the lowest temperature we had yet experienced: it felt most uncomfortably cold.

cultivated. Wells of the depth of from 15 to 20 feet I found to vary in temperature from 81° to 83°,—even in the sun the mercury scarcely rose above 60° At Bombay under the same circumstances it would have been 110° at least. The first six miles of our road was flat and sandy and very barren. About 9 we stopped at a large village with a lake of considerable magnitude close by. I never remember to have experienced a cold so persistent: at sunrise it had been 43°, it was now only 45° and the thermometer fully exposed on the dry sand to the direct rays of the sun only rose to 57°, and refused to get higher even when covered for 10 or 15 minutes with a piece of black silk. The water here was 50°, but at a little distance off I observed a well being drawn upon, the water of which steamed like a cauldron for full half a mile along the channels which supplied the fields. Thither I repaired to dress: the water was only 30 feet deep at surface, the well 40 in all, and my only regret was, that it did not provide the means of bathing. Some magnificent trees close by were literally covered with long-tailed monkeys—the females in many cases rocking their young to sleep by hanging by one hand and one foot to a slender branch, and swinging for a sweep of some feet, with the other arm holding the little one to the breast. They approached so near, and watched me so narrowly with such utter absence of all alarm, that I was more than once apprehensive that I might see some of them dressed in the clothes I had just thrown off. The water fresh drawn was 85°; at this it felt disagreeably hot. As we approached Dolka I made drawings and measurements of several singular looking vehicles, all apparently quite new, of extraordinary length, and with from six to eight wheels, like those of the common carts of the country. I presumed that these were going to bring in heavy logs of timber, there being many fine trees in the neighbourhood. On enquiry it turned out that they were not vehicles at all, but that this was the customary way of taking new cart wheels to market. As many axles and pairs of wheels as could be conveniently attached together were made fast to a long pole, and so dragged along. It furnished a good lesson of accepting nothing mysterious as fact without minute enquiry.

Dolka is about 22 miles S. W. of Ahmedabad. The city with the adjoining villages contains a population of above 100 000. There are said to be no accurate records in existence regarding it: it is believed to be the oldest town of any note in Goozerat. It is about seven miles in circumference, abounding in fine wood and the remains of rich mosques, tanks and gardens.

The most remarkable thing about Dolka is a beautiful lake about 100 yards in diameter, built around with a finely cut and enriched stone wall, with flights of steps down to the water at regular intervals. In the middle are the remains

of what must have been a singularly elegant mosque or temple, and this is connected with the shore by a light and graceful wooden bridge supported on sculptured stone piers. The platform and roadway are mostly gone, but the piers, consisting of lines of handsomely cut pillars, remain entire. There are fine rows and groups of magnificent trees all around; multitudes of females were carrying away water, washing, or sauntering around, and the beautifully selected colours of their graceful dresses presented a scene altogether as picturesque as well might be. The rest-house here is a handsome dwelling* occasionally occupied by the Collector or settlement officer, and the garden close by—with the productions of which, I fear, I took more liberties than a strict regard to *meuum* and *tuum* warranted—is excellently kept and abounds with English vegetables. We remained at Dolka from noon till 5 P. M., and regretted having left no room for a longer sojourn; but we were anxious to get to Ahmedabad as early as possible next forenoon (Sunday), in hopes of being in time for divine service.†

DOLKA TO AHMEDABAD.—Our journey now lay nearly northwest and northerly. The first seven miles of district we traversed was flat and somewhat barren; after this evening set in, when I was no longer able to observe the kind of country we were traversing. We reached the village of Soorora, where we slept at about 9 o'clock. The Thermometer had sunk to 62°, by dawn it was as low as 41°—the sky was pure and cloudless, like that of a Scotch winter night, and a northern temperature of 20° felt far less uncomfortable than that to which we were now being exposed. We crossed the Saburmuttee at dawn: it was the first Indian river I had ever seen in the fair season,—the first of those flowing westward I had ever seen at all; and as I was, amongst other things, in quest of a locality for the commencement of a great scheme of irrigation, it presented to me peculiar attractions. Rising beyond the great mountain mass of Aboo in the western limit of Rajpootana, after receiving various small-sized tributaries, it traverses about 200 miles of tolerably even country, and discharges itself near the debouchure of the Mahae, at the northern extremity of the Gulf of Cambay. At the place where I crossed

*Mr. Fawcett's Report on the Collectorate of Ahmedabad, extracted from the Government Records, No. V.

† Barometer at Dolka Bungalow:—

P. M.	Ther.	Bar. corrected.
2 20	70°	29·991
4 20	69	29 949
4·40	68	29 969

The air felt crisp and dry. The Bombay *minimum* at 4 P. M. at this date was 29 932—actually lower than at Dolka after my reading is reduced to 29 919, by the subtraction of the index error of 030.

it, some 14 miles southward of Ahmedabad, it is about 100 yards from bank to bank; but not one-fourth of this was occupied by the stream as then existing. The banks were of a hard stiff yellowish clay, almost the only soil prevalent in these parts; much cracked, occasionally in layers, and slightly interstratified with thin beds of sand; they were from 15 to 20 feet in height, and nearly perpendicular, in some places indeed overhanging. The whole channel is covered over with fine white clean looking gravel about the size of peas, occasionally changing into coarse sand, nowhere getting the size of walnuts or even filberts. The particles are mostly quartzose, with numberless beautiful little specimens of agate and carnelian, and a vast amount of the minute debris of land shells. The river must be very majestic when the channel is full; at present the whole expanse just described was filled by a beautiful pellucid stream running at the rate of about a mile an hour, about 100 feet across, and 1¼ to 2½ in depth. Irrigation here was wholly out of the question.

I walked from the Saburmuttee to Ahmedabad,—no great feat for a European certainly, but not an over prudent proceeding, as the results will shew, for India, unless at a much earlier hour of the day. At first the roads were deeply rutted and irregular, but beautifully fringed in general with vegetation; for the last six miles they were of sand ankle deep, as if forming the favourite river channels of the rainy season. Though a tolerably fleet pedestrian, quite accustomed some seventeen years ago to 30 or 40 miles a day for a series of days on end, I took quite five hours to cover little over a dozen of miles, feeling much more fatigued on my arrival at the rest-house at noon than if I had walked thrice the distance.*

AHMEDABAD—on being approached from the south west, becomes conspicuous full five miles away. The city is surrounded and interposed everywhere with magnificent groups of trees—contrasting beautifully at this season with the parched brown of the soil, surmounted as they are by the majestic remains of the triumphs of Mahomedan architecture. The seeming grandeur of the scene at a distance is not noticed on approaching, still less on entering the city, where the mosques and mausoleums, fine as they are, look half ruined, neglected and slovenly, and are buried amidst the falling squallid streets and narrow thoroughfares that form the characters of all oriental towns.

Ahmedabad has been so often described, that it would be superfluous here to give more than the briefest possible notice of its history and appearance.

* The following is a list of villages from Dolka to Ahmedabad 24 miles, Dolka Mookedpoor Soorora here we stopt) Nagora (just across the Saburmuttee) on the eastern bank—Cummoie—Ahmedabad.

The northern capital of Goozerat, on the banks of the Saburmuttee, was formerly one of the first cities in the East. It was built about the year 1426 by the Sultan Ahmed Shah, on the site of a still more ancient town. It is said at the time of its greatest splendour to have occupied suburbs including a circuit of 27 miles : at present it is reduced to less than a fifth of this.* It was enriched by its founder by many noble mosques, tanks and other structures, the most magnificent of the former being the Jumma Musjid, or Grand Mosque, which stands near the middle of the city. The minarets of this building, together with a great number of other spires, and about three hundred houses, were thrown down during the terrible earthquake which desolated Scind and Western India in the middle of June 1819. The city everywhere abounds with relics of ancient grandeur, and few more acceptable services could be performed to Archæology, than a good collection of faithful drawings or large-sized photographs of the architectural remains of Ahmedabad.† Ahmedabad is still famous for its gold, its silks, and its carved work, and its merchants and brokers enjoy a distinguished reputation for liberality, wealth, and enlightenment. They lately (May 1856) subscribed Rs. 50,000 for the erection of an university amongst them,—an establishment for which I think it doubtful if any city in Western India will be ripe for half a century to come ; but the contribution was an evidence of their anxiety for education, mistaken as their views might be as to the best mode of attaining it.

KAIRA.—Early on Monday morning I left Ahmedabad for Kaira, formerly a military station, about 22 miles to the south east. For several miles after getting beyond the gates of Ahmedabad, are splendid fragments of ruins—mosques, mausoleums and tanks, in the midst of the most beautiful groups of trees I have ever seen. I measured several wild mango trees from 15 to 18 feet in girth. We passed one magni-

* Forbes' Oriental Sketches.

† It may tend to the advantage of future travellers to mention, that the Bungalow of Ahmedabad though a very neat and comfortable building, was, on the 13th January 1855, the filthiest human residence I had ever entered, the attendants being models of incivility. I do not know who the party was responsible for this, but the state of matters was most disgraceful—the people almost as uncivil as the premises were filthy. The mean temperature of Ahmedabad appears to be 80°, from the mean of ten years, the same as Bombay, though four degrees further north. A well 30 feet deep close by the bungalow was 81° at 9 P. M., at 68.°

At 9 P. M. Ther 62°—Bar. 29·939. Morning maximum at Bombay following morning—sixty, and close of day at the Observatory 30·06, the previous morning 30·040. The difference betwixt the Ahmedabad observation .065 is scarcely more than is due to that betwixt the morning and evening maximum at the presidency at this season. From the Government Observations generally I should infer, that the mean pressure considerably increased northward.

ficent tank about 700 yards in circumference. It is eight-sided, the parapet and retaining wall descending by three large steps 3¼ feet perpendicular each and two feet across, from summit to water surface 14 feet. There are eight handsome double sets of steps, one on each side, descending to the water, the whole forming a very elegant piece of architecture indeed. The country here is singularly rich and beautiful, the roads most execrable; but the Natives have never known better, and did not complain: how governments that produced architecture so exquisite should have put up with thoroughfares so execrable, is not very easily explained. We had somewhat lingered on our way in the forenoon, and it was past nine o'clock before we reached our quarters, in which was formerly the officers' barracks in Kaira, and so we missed seeing the town.

Kaira is the capital of the district, now the Collectorate of that name, and is the head-quarters of the judge and magistrate. It was acquired by us from the Guicowar in 1805. It contains a population of about half a million, and yields a revenue of £200,000 a-year. The cantonments, now ruined and desolate, are about a mile south of the town. Here a considerable force used to be maintained, the European portion of which consisted in a troop of horse artillery and regiment of dragoons. The station had always been sickly, and in 1824 H. M.'s 4th Dragoons suffered so severely that it was abandoned, Kirkee near Poona being, from that date, the only Dragoon station in the presidency. The barracks are now mostly unroofed and hastening to ruin, and the officers' quarters, in which the traveller finds refreshment and repose, are still in good repair, and the neatness and cleanness of the apartments, and attention of the people in charge, formed a pleasing and very striking contrast to the state of matters met with the previous day at Ahmedabad.

The Barracks stand on the highest part of a fine English park-looking plateau, sloping on three sides down to the river, which here makes a nearly semicircular bend. In the middle distance, just beyond the river, peeping from a magnificent grove of trees, is one of the rarest things to be met with in India, excepting in our largest sized towns—a really handsome and tasteful Church and spire. It was, like six others, built in Mountstuart Elphinstone's time, and opened for worship in 1823. It is much the form of that of Tanna, and not unlike the Byculla Church; it cost £7,500, and would probably accommodate 800 people; it is very neatly and tastefully fitted up, and kept in tolerable order. Singularly enough both steeple and walls are painted of a deep blood red—the corners, cornices and architraves left white; and what is still more singular, unusual as the colour is, and strange and harsh as it might have been supposed amidst the rich green of the adjoining foliage, it did not strike the eye as at all unpleasing. I only wished they had left

the spire white, and hope when next coloring season comes around this may be attended to. The portico is spacious and handsome; I counted no fewer than thirteen hives of bees—if the phrase hive may be employed where combs some cubic feet in mass were adhering naked to the inner corners of the pannelling, under the collonade. The gravestones outside are nearly all destroyed, the marble slabs having been picked out, I presume for the purpose of burning into quicklime.*

The following are the only inscriptions I found in the interior, on two small marble tablets.

Sacred to the Memory
of
GEORGE HILLIERO BARLOW, Capt. H. M. 4th Dragoons.

Eldest Son of
Sir George Hilliero Barlow, Bart.
Governor General of India.
Ob. 13 June 1823. Etat 33.

Sacred to the Memory of Ensign GORDON.
7th Bv. N. I.
Who fell at Dhollera, 22 Oct. 1824.

The river Walruck, between the cantonments and church at Kaira, on the road to Baroda, is crossed by a handsome wooden bridge. It is two hundred and fifty feet in span, being supported by fourteen pairs of iron pillars coupled with a screw clamp about 15 feet down. The centre of the bridge is 30 feet above the surface of the water—this being about the height of the banks all along; the water is 10 feet from surface to the bottom at its deepest; the volume seems considerable, but the flow is so gentle and slope so slight as scarcely to have been perceptible.

We left about noon, the country continued remarkable for its fertility and beauty; we had fine large isolated pools as before, but they had lost one element of beauty—they ceased to be bright and transparent, and were yellow with mud from the extreme clayness of the soil. The accompany-

* The Bishop on his late visitation tour (Feb. 1856) complains of this. He could only muster a congregation of 16—probably a larger proportion of the whole Christian community in the district than could have been mustered for service in much more populous parts of the presidency. The same destruction of tombstones is in progress in the graveyard of Matoonga, a couple of miles from Government House, Bombay. Here three battalions of Artillery were quartered till 1829, when the extent to which the men suffered from Guineaworm, made the whole be transferred to Poona and Ahmednuggur. There seems to me few things so melancholy as a burying ground left deserted and in desolation, yet the dead know no solitude: we are thinking of living sociability when we dream of the inmates of the house of silence suffering from loneliness.

ing village was no longer universal, and when the ground abounded with wood the groves usually attendant on the tank and wells, alone, scarcely seemed conspicuous.

We were now fairly within the British dominions, and one very conspicuous change in the arrangement of the villages had become apparent. Throughout Kattiawar they are surrounded either by walls of some sort or other, by prickly-pear hedges, or by piles of thorny brushwood through which a depredator would find it difficult to make his way. In most cases the shops and houses turn their backs upon the narrow streets and lanes, and are built in hollow squares with generally a fine tree, or sometimes a well, in the centre —the entrance to the square being shut in by a gate,—all of course indicating the comparative insecurity of life and property ; and all this occurs *in* petty states wholly under our protection. The village can in general be entered by one thoroughfare only, or at most two, those of ingress and egress. From Ahmedabad south the villages are all perfectly open, the streets, such as they are, tolerably clean, and no suspicion or fear of danger from violence or plunder is anywhere manifested ; the entrances in fact from the open country are so numerous and so like each other as to be occasionally perplexing to the wayfarer disposed for a ramble without a guide—not caring much where he goes, but to whom it is of importance that he finds his way back to the place whence he came, or to the highway at all events. On asking from time to time at the people we met with if there were many thieves or robbers in the neighbourhood, we experienced on all occasions the same answer :—" there may be, but we know not of any ;"and the law maxim surely in this case may be held to obtain : " betwixt the non-existent and non-apparent there is no difference.

KAIRA TO BARODA.—The magnificence of the trees in this part of Goozerat strikes the stranger still more forcibly than even the richness of the cultivation. It is not that they look particularly old, but their gorgeous luxuriance combined with their magnitude, obvious health, and graceful contour, conveys an impression of beauty at once and grandeur, larger and older trees in less redundant vigour fail to call forth. I measured a Banian, not at all apparently above average, with a girth at the clean bole, free of all tendrils, of 41 feet : it spread over an area very nearly circular of 150 feet in diameter—thus covering a surface of 1575 square yards, or about a third of an imperial acre.

TUESDAY, 16th Jan.—Leaving Kaira about 8 A. M., we reached the large village of Neriad at noon ; it is clean, and looks flourishing, with a fine lake in the middle. I had walked some miles ahead of the carts, and was taken by the policeman to the traveller's bungalow. Before I had

reached a message followed me, requesting me to go to the cutcherry of the Collector. Here we found a large native establishment at work on revenue matters, most of them fine, clean, intelligent-looking men, many of whom had grown old in the service. There was no European on the spot, but civility to strangers seemed to be a standing order. The residence of the Collector was thrown open to us at once; we found everything neat and clean, and the Revenue Commissioner himself could not have received greater attention Quitting Neriad in the afternoon we crossed the Mahae, and entered the dominions of the Guicowar just before dark. The river here is very similar in all leading features to the Saburmuttee, where we crossed, 14 miles S. W of Ahmedabad. It is about 450 yards across, of which the water occupied some 50 yards to the depth of about a couple of feet. The rest of the channel is covered with beautiful white sand and fine gravel, both abounding in minute fragments of agate and carnelian. The banks are of dark yellowish clay, of 20 to 25 feet in height, precipitous and often overhanging their base. The water in the river, like most of that in the open pools, varied from 40° to 50° in heat at daybreak, being five or six degrees below the mean of the air; the wells when above 30 feet varied from 80° to 81° A little after daybreak I found myself approaching the British Cantonment, Baroda, through a long avenue of trees. The thermometer at this hour was 46° with a strong dry cutting north wind, cold and comfortless. On the verge of the drill ground is a Catholic chapel and churchyard, and close by the road is a simple monument with the following inscription in English and Marhatta.

1831

ABAJEE SHAMJEE, Soobadar, 25th Regt. N. I.

THURSDAY, 18th January.—Baroda is the capital of that portion of Goozerat still subject to the dominion of the Guicowar, a Marhatta chief formerly holding under the Peishwa. I visited the town, which is about two miles from the cantonments, the day of my arrival. The Marhattas made it their boast that they lived by war and on horseback, or in tents, and paid no regard to the beauties or luxuries of architecture; and nothing certainly could contrast more strikingly with the magnificent monuments of Mahommedan taste and splendour at Dolka and Ahmedabad which had filled us with admiration, than the wretched mass of miserable structures, the narrow streets and unseemly public buildings which constitute the regal city of Baroda. The Guicowar was returning home as we reached what is termed the Palace, with elephants and horsemen, and footmen and music, and shouting the most discordant yellings, the most motely crowd that could be conceived. The band of a caravan of wild beasts

at a country fair in England was dignity and splendour, compared to the mock pomp and beggarly circumstance attendant on the crowd in the procession of one of the last of the Marhatta sovereigns. Yet Baroda is a place of vast wealth, it contains a population of above 100,000, is the seat of the administration, and has long been proverbial as a den of political corruption The houses of the cantonments are arranged in two long parrallel lines, with a fine wide, smooth, grassy space betwixt of about 200 yards across and three quarters of a mile in length. Near the centre is a monument to the memory of the late Mr. Williams, our first Resident, unfortunately left without an inscription. The Residency is a very handsome, indeed a noble-looking building, a considerable distance to the westward, and nearly in line with the vista just described.

The place upon the whole must, I fear, be pronounced dull and uninteresting. The Resident was absent on a hunting and fishing expedition on the Mahae, where he was to be joined next morning by the Guicowar. Neither of these two varieties of amusement are pursued quite in the way that meets an Englishman's conception of sportsmanship.

At the periods of spring-tide, when the Bore prevails, a large wave rushes up the Mahae with great velocity. When it has completed its ascent, and before ebb begins, a net is shot across, when vast multitudes of fish are entrapped. What is called hunting, again, consists in surrounding a wooded space into which game of all sorts has previously been driven. The sportsmen, mounted on elephants, take up a post near the only point of exit permitted, and the terrified creatures are killed at pistol-shot distance as they endeavour to make their escape. Such are the views of the Marhatta Prince of sport, sufficiently wide certainly of those of British sportsmen, who spear the wild boar from the saddle, and beard on foot the tiger and lion in their lairs.

We had once more begun to see clouds in the sky, and to enjoy those lovely vapour landscapes overhead, the want of which was felt previously to be absolutely painful. Hills now also came in view, Powanghur being conspicuous. This noble eminence is 1800 feet in elevation, and looks from its isolation much more. It has been strongly recommended for a convalescent station, and is a favourite hot-weather resort for the residents at Baroda. With a temperature from 15 to 20 degrees lower than that of the plains. From March till October strong, often violent, winds prevail from the S. W. from dark till daybreak, when perfect calm exists not only in the low country but half way down the hill. The phenomenon is singular and not very easily explained: there seems no reason to doubt of the fact

stated to me by an officer of much intelligence, and who had long resided on the hill.

The Brigade Major, Capt. Crawford, had for some time been anxious to obtain a much more copious and trustworthy set of meteorological observations at Baroda than had heretofore been taken. I carried with me accordingly a set of instruments for his use. The barometer meant for him, a very fine instrument indeed, had unfortunately got its tube broken in the tremendous joltings of the Goozerat roads. It had before this got injured on its way from home, and I had just put a new tube in it, and not taken, I fear, sufficient care to pad it with cork. On lying slightly inclined in the bullock cart, the glass snapped with the load of the mercury. I left behind, however, the instrument I had taken with me for my own use, and have no doubt that under supervision so able and energetic the results will be found valuable.

Baroda is the only place in Goozerat where good arched bridges are to be met with, and the apparent lightness of one of these, called Waddington's Bridge, from the distinguished engineer by whom it was built – (now General Waddington, head of our Public Works' Department) made it be looked on by the people with suspicion. The Guicowar could never be persuaded to trust himself across it on an elephant.

BARODA TO BROACH.—I quitted Baroda at daybreak on the 19th, and walking through a portion of the town passed the Mootee Bagh, a garden house of the Guicowar, just as his Highness was preparing to join the Resident for a grand hunting party on the Mahae, and was thus furnished with an opportunity of witnessing the nature of the turn-out customary on such occasions. Six elephants richly caparisoned and almost covered with scarlet cloth, stood near the gate, with not fewer, I should think, than 500 horsemen very picturesquely equipped, but with as small regard to uniformity as could be imagined in a body of military. The only thing common to them all was the native crooked sword, or tulwar. Nearly all had firelocks of some kind or other :—Long native matchlocks of every form, muskets, English rifles and fowling-pieces, single and double barreled, flint or percussion, as the case might be. Though of a vast diversity of ages, they were nearly all muscular, strong, active looking men, probably not unformidable in the field if properly led. His Highness himself is a diminutive, undignified dark-colored man, who certainly impresses the beholder much more with the idea of his sensuality—especially his addiction to opiates and strong drinks, than as endowed with any great amount of talent.

The wells a little south of Baroda measure from 40 to 60 feet in depth; the temperature at the surface of them on being carefully drawn up was mostly

about 70° —a little way down it rose to 80° and so continued to the bottom. I here met in with a fine specimen of that clumsiest of trees, the *Adansonia Digitata*: it measured 38 feet in girth, with various beautiful Tamarinds from 8 to 12 feet, the latter being, so far as I know, an unusual size for this variety of tree. About ten miles to the south of Baroda I met in with the first genuine specimen of the true black Cotton soil I had observed; a more particular account of it will be found at the end of this paper. The soil of Kattiawar consisted of a light rich sandy loam—those from the Runn eastward and south of a tenacious yellow clay. Some seven or eight miles south of Baroda are the remains of what appears to have been a large massy bridge of brickwork —the foundations of the arches and two entrances alone remaining. This I presume to be that described in Forbes' Oriental Sketches, as crossing the river Biswamertree. The engraving he gives of it represents it as consisting of two tiers of arches, one below the other, the lower tier consisting of five, the upper one of eight, the parapet being pierced at regular intervals with arches of lesser size. The structure as represented is a handsome one, and the writer speaks of it as the only arched bridge he had ever heard of in India. But for the drawing it would now be impossible to discover what it had ever been.

As we had performed a journey of considerable length in the morning, and had still a long stage before us, a good part of which required to be gone over in the dark, I ordered the bullocks an extra feed, which I fear proved fatal to one of them. When within a few miles of our journey's end, at the village of Tankaria, he seemed uneasy and out of wind. He was unyoked, and in a few minutes dropped down and died. The night was very dark and the road indistinct, but we, believing we were not more than a couple of miles from the travellers' bungalow, sent the guide ahead to get another bullock. After waiting for a couple of hours Dinshaw and I started, leaving the cart in charge of the driver. We found fires blazing in all directions, and on going up to one of them learnt, that they were lighted every night at that season of the year to prevent tobacco leaves, then being collected and prepared, from being stolen. This tended more and more to lead us astray, till at length we got a guide, and on reaching the bungalow found our messenger had never arrived. We sent out another on this occasion with bullocks, but he not returning was supposed to have lost his way. I started off at daybreak, afraid anything might have happened to our driver, a fine intelligent fellow supplied us along with the means of conveyance by the Thakoor of Bhownuggur. He had seen no one, and had sat all the night betwixt the living bullock and the dead,—the latter fearfully swollen, was lying on his back with his

legs in the air, to be skeletonized in a few hours by vultures and jackals.

Tankaria is a very considerable place where cotton is largely collected and packed for market; we found the country around literally covered with carts and travellers. The district seems very fertile, and the cultivation good.

MEEAGAUM.—We reached the town of Meeagaum sometime after noon (19th). It is a place of considerable size and importance, a fine river channel, about 50 feet across and nearly as much deep from the top of the bank to the gravel, runs for a considerable space parallel with the wall. The running portion of it was reduced to a mere streamlet, yet it still retained the aspect of a river by being every here and there ponded across, extending the stream in large bright pellucid pools filling the entire breadth of the channel. In the channel itself were numbers of strongly-built wells of moderate dimensions, and the water, outside and in, of pretty much the same apparent purity and level. The fact of their withstanding the torrent during the rains shews that it must be of much less violence than might be supposed; the wells themselves are, I presume, meant rather to collect water by percolation as the dry season advances than to guard against impurity. The Thakoor of Meeagaum and his people have long been in rather indifferent repute from the multitudes of robberies that occur in their neighbourhood, in the fruits of which they are said to have no objection to participate. Standing in the great line of intercourse betwixt the British dominions to the south and north, merchandise is intercepted, and even when the thieves are caught, or when they surrender themselves, it becomes quite worth their while to take a year or two of imprisonment, when they emerge with a fortune. The custom at one time was, to make the Thakoor responsible for the restoration of the goods, or an equivalent; and this, though doubtless in many cases harsh and unjust, seems the only way of dealing with men of rank, not at all events above the suspicion of protecting highwaymen for the sake of sharing the spoil.

BROACH.—We reached Broach late on the night of the 21st. I was anxious here to make as minute an inspection as I could of the Nerbudda; and as the pace at which I had hitherto travelled left me a little margin for securing my return to Bombay in time, I resolved to spend a couple of days here. On visiting Mr. Landon, by whom a large spinning mill was then being constructed, he insisted on my making his house my home. Nor could I have desired one more elegant, nowhere could I find one more comfortable.

When at Broach, the construction of a great cotton factory was rapidly advancing under charge of Mr. Landon. This gentleman

having been long engaged in the cotton cultivation in America, came to India seven or eight years since, to assist in conducting the experiments then in progress under Government: to see if it were not possible to introduce the cultivation of long staple cotton, and to improve the modes of cleaning or removing the wool from the seed. A considerable amount of experience satisfied him that the plan pursued by Government was not promising, but that there was abundance of room for the introduction of private enterprize. Being in England in 1850 he explained his views to the Court of Directors, and at once tendered his resignation, when the Directors with equal liberality and wisdom recommended him to hold on his appointment till his own personal arrangements were made, as the pursuit of the course contemplated had formed the aim of all their projects: they merely wished to experiment until they could allure private enterprise into the field. On starting on his own account, Mr. Landon first began with saw-ginning on the large scale short-staple native cotton; he gave up all attempts at introducing the American variety. In this he proved eminently successful, and speedily earned such a name for skill and enterprize as to find no want of Bompay capitalists to back him. In 1852 it was resolved that a large spinning mill should be established; when I visited him in Jan. 1855, it was hastening towards completion. It is to be worked by two high-pressure engines drawing their supplies of water from wells 80 feet deep. The mill work is on the ground there is no upper flat, the roof is supported by strong teak uprights, the space closed in being 180 by 200—36,000 in all, or close on three quarters of an acre. Mr. Landon has been left entirely to his own resources, and allowed to manage matters very much as he thinks fit, and under such a system I see little fear of success under such a man.*

At the commencement of new forms of enterprize in India, everything depends on the man: were Mr Landon removed by any cause before his mill is fairly at work, it would be difficult indeed to find a successor fit to take his place.

The mill occupies the site of the favourite gardens of the Chief of Broach. His residence and Zenana are now occupied by Mr. Landon. The puff and plunge of the great steam-engine, the dizzy whirr of ten thousand spindles occupy the spot where half a century before the sensual Marhatta looked out from his lascivious couch on his troops of dancing girls, or listened to the music of the rote, or jingle of the anklet ball.

I unfortunately missed seeing the burying ground of the Dutch Merchants

* The following account of the starting of the Broach Mill is taken from the Overland *Bombay Times*, Oct. 17, 1855:—

"BROACH.—Monday, 8th October 1855, will long be a Red-Letter-Day in the annals of Broach, as that on which the first Cotton Factory in Western India was

formerly resident at Broach, and should have greatly liked to have been able to compare them with those at Surat. The inscriptions are stated to be quite legible, the dates to extend from 1654 to 1770.*

Broach is a place of very considerable trade, and forms the shipping port of Malwa, from which goods are received, and to which they are sent over distances varying from 100 to 300 miles, over roads so bad that it requires from 6 to 8 bullocks to drag a cart which will scarcely carry half a ton. The Cyclopean proportions of the vehicle, especially the wheels, and strength with which it is bound together, as well as the number of cattle required to draw it, indicate the difficulties to be surmounted on the way.

The fruit of the Mowra, or Mowa, very greatly resembling the common date, but more starchy and insipid, and less saccharine, is brought down in large quantities chiefly for the purposes of distillation, about 500 cart loads reaching every season. It yields a strong fiery spirit which is very often, indeed believed to be distilled from the petals of the flower,—which scarcely possess any of the bases of alcohol in sufficient quantity to yield any spirit at all. The chief exports are cotton, which is grown in large quantities all arouud ; its imports amount in value to betwixt £150,000 and £178 000, its exports to above a third over this.

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first set to work, just ten months from the time the first sod was turned for its foundation, an event the most important certainly that has occurred in the Western Presidency since the inauguration of our first railway on the 16th of April 1853. The importance of the first, like that of the second great occurrence just mentioned, seemed to have been overlooked by those most concerned in its results. The Governor, the Commander-in-Chief, and the Bishop, set forth on their usual holiday expedition to Mahableshwu , as our chariots of fire and horses of fire were about to rush forth on their mission, as if a week of Mahableshwur air had been to them matter of greater interest than the welfare of the millions of India ! When Mr. Landon let loose his myriads of dizzy wheels, he was the only one of all who had assisted in the glorious work now completed, to witness the first results his master mind had conceived—his energy carried into execution. Only one engine was required at the outset; though the whole of the machinery was ready for spinning, it can only be brought into use as the natives, of whom five hundred will be required, are trained in the art of superintendence. The working of the engine and machinery was perfect, and we trust it may prove a favourable augury of the success of the final issue, that from first to last no impediment or obstruction worth mentioning has been experienced and no accident whatever has befallen either workmen or material. Mr. Landon may well be proud of the success that has thus far attended his operations, and those who were clearsighted enough to discover his merits, and sufficiently stout-hearted to second his efforts, deserve, though in a minor degree, the cordial congratulations and grateful acknowledgments of the community, while rewards much more substantial than these are, we trust, awaiting them in the shape of munificent returns."

* Memoir of the Zillah of Broach, Government Records 1852. The statement is made by Col. Morier Williams, Surveyor of the Presidency for 1820. I do not know that the same thing still obtains that held good 40 years ago.

Broach,—the Barygaza of Arrian,—seems to have been well known to the ancients, and was probably, two thousand years ago, a place of much greater importance than it is now. The province comprises six pergunnas: the Baroach proper, the Unkulsur, the Hansot, the Jumboosur, the Ahme. The first of these was acquired in 1803 from Scindia by conquest, the other five by cessions from the late Peishwa. Unklesur and the Hansot by the treaty of Bassein, Dec. 1802; the three last by the treaty of Poonah 1817.

The pergunnah of Baroach itself, contains an area of 235.778 acres, or 417 square miles. A portion of the town stands on a high bank of earth about 80 feet above the river, which it on one side almost overhangs, with a series of large suburbs along and around the slope or base of the steep. It was in 1772 besieged by an army from Bombay commanded by General Wedderburne, who was killed under the walls: a few days afterwards it was taken by storm. After having been held by us for ten years, it was made over in gift to Scindia by order of the Bengal Government in 1783,—the withdrawal of the English being, according to Forbes, then Resident, matter of deep and universal regret by the inhabitants. The present English church stands in the breach through which our troops advanced.* I did not observe a single building capable of attracting attention, or any attempt anywhere at anything deserving so much as the name of architecture.

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* It was afterwards made over to Scindia in 1782, and was taken from him in 1803. I am not certain to which of the two captures the breach mentioned in the text was due. I take the fact from the journal of the visitation of the Bishop of Bombay, Feb. 1956. It was on the latter of these occasions that a large quantity of British property fell into the hands of our army, and became booty of war, Messrs. Bruce, Fawcett & Co., (now Remington & Co) were the chief sufferers:—the question was referred to General Wellesley (the Duke) then on a visit of a few months duration to Bombay, and became the subject of a very admirable letter on the rights of besieging armies to all the property they capture. The following extract from the Despatches is worth quoting, even in a brief outline of the Journal of a hurried tour: if acrimony and ill-feeling were always thrown aside, how much more valuable work might we not get through with.

Camp, 31st Oct. 1803.

'1. I have had the honor to receive your letter of the 19th instant, with its enclosure, being the copy of one from Messrs. Forbes and Co., and Messrs. Bruce, Fawcett, and Co.

2. As far as I am concerned in the property captured at Baroach, I am of opinion that the proposition of those gentlemen is very reasonable, and that it ought to be complied with.

3. In respect to the letter from those gentlemen, it might probably have been as well to have omitted all the injurious expressions and reflections which it contains'

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6. The question respecting the property belonging to British merchants found at Baroach is, whether it is included in that reserved by His Majesty in his Royal Charter. Those concerned in the capture, I conclude, think it is; the merchants

Broach seems remarkable, if half the stories we heard were to be believed, for the length to which Hindo orthodoxy is carried out, and the extent to which it is occasionally practised on. As the slaughter of animals of all kinds is forbidden,—rats, mice and other vermin, as may well be supposed in a place so filthy, are plentiful. The Hillmen, who have no such prejudices on these points, make the abundance source of gain,—collecting all sorts of animals that come within their reach, provided they cannot be claimed as property; they take them to the wealthiest and most credulous Hindoo in the neighbourhood, and threaten to destroy them. Upon this hey are bought up and liberated, and severe haggling for the life of a more than ordinary vigorous rat being a case of constant occurrence. Those that have been once caught and set free uninjured—probably indeed with a gift of some grain for their good conduct,—are not difficult to recapture; and so on falling a second, or third, or any number of times into their hands, they become ransomed by some fresh simpleton. This indeed we were assured formed quite a branch of trade, and the money realized by individual speculators familiar with the ups and downs of rat life, were represented as astonishing

The Nerbudda, which passes Broach, is even in the dry seasons a very noble river. It measures 450 yards from bank to bank when the tide is out, and nearly a third more at highwater: the tide rising about 5 feet. The harbour is very bad and the pier for passage-boats—if it deserves the name,—a mere mole or mound of earth, the portion covered at high-water ankle-deep of mud. There is a low island on the southern shore always submerged by the flood but attached to the mainland during the fair season, and beyond this there rises a second step to the altitude of about 30 feet, so as to be above the limits of the ordinary inundation, and only under water when the river is unusually high. The general rise during the rains seems to be about from 15 to 25 feet; it frequently gets the length of 30, and has been on many occasions known to be above 40 feet in height.

Judging from the map, Western India presents no more attractive field for irrigation than the magnificently fertile tract inland from Broach, and just

think it is not. But surely there is no occasion for interference or acrimony of expression, on reflection, in urging the claim of either party.

7. Whatever may be the fate of the property hereafter, it is certain that if it had not been for the gallantry of the troops who took Baroach, it would never have come into the hands of the British merchants; and it might be as well, possibly, to refrain from accusing of injustice and unjustifiable measures, those to whom such benefits are to be attributed, only because they state their doubts respecting the real ownership of the property, which, according to the writers of the same paper that contains these accusations, is a question involving points of a peculiar and delicate nature.'

to the northward of the Nerbudda, and the large level space extending to the southward from the mountains to the sea, as far as the Taptee at Surat. Col. Grant, long superintending engineer in Guzerat, had strongly recommended canals in both districts, and Mr. Mackay, who went some way up the river on purpose to satisfy himself as to the practicability of the scheme, confirmed Colonel Grant's views, and renewed his recommendation for its early commencement. Anxious to obtain all the information I could on a question so important, I proceeded up as high as Junore, a village about 15 miles upwards by the road and about 20 by the river. Nothing could surpass the beauty and fertility of the country through which we passed, three-fourths of the fields were in crop, nearly the whole of the remainder thoroughly cleaned, or preparing for another sowing, and we hardly saw an acre of ground that did not appear to be under the highest cultivation. For water they were entirely dependant on wells—many of them from 30 to 40 feet in depth, and the people everywhere assured us, that no prices would be considered too high for a canal perpetually flowing. The results seemed so promising that the pursuit of the enquiry became quite exciting.

Alas for the result. We no sooner got within sight of the river than it became quite clear that a project of which so much had been said, and which had excited such lofty expectations, was utterly chimerical and hopeless.

Not trusting to the eye, or to estimate or conjecture, I had taken a theodolite with me. It was not difficult to plumb the bank by a long bamboo laid over it and a string and stone at the end. I found it here from 40 to 50 feet perpendicular, rising to an altitude of from 70 to 80, a little way landward, and this monstrous mass was to be cut through before our canal head could be constructed—the ground all down to the sea sloping so gradually, that the water could never have been got except at flood within 20 feet of the surface with a canal 50 feet deep. To the southward the bank sloped away very gradually for nearly half a mile, and deceived the eye as to its altitude; on using the theodolite as a level, I found that much within a mile the surface attained an altitude of 50 feet, which seldom seemed to sink lower than 30 all the way to the Taptee. The idea of a canal on this side was, therefore, nearly as much out of the question as on the other, the ground being infinitely less fertile; so here was an end of our project at once. How two authorities so eminent as those just quoted should have erred so greatly, or how any doubt should ever have been entertained of a fact so easily conclusively determined, is not easy to be comprehended.

I repeated my observations at a diversity of points for half a mile up and

down, to leave no doubt about the matter, but found the results so nearly uniform that there was no room left for hesitation.

My purpose was to have ascended the river by boat, to have examined the islands, and seen the celebrated Cubber Burr—the largest Banian tree in Western India, but I found the mode of conveyance so slow and uncertain from the frequent risks of grounding, that it was not to be thought of considering the little time I had at my disposal.

Jan. 23.—Left Broach for Kem-Chowkee, the next long stage towards Surat, about 7 A. M. As already stated the shore just southward is only about 10 feet above the low-water level of the river, and must be an island half the year and altogether submerged in floods. The land soon rises by a second step about 20 feet higher than this, or 30 above the river, and slopes very gently eastward to the village of Aclaiser; here the surface of the ground arises suddenly by a further step of 10 or 15 feet, and attaining the general altitude in all of 45 to 50 feet, and so continues all along. The character of the soil as much as the level of the surface here suddenly changes;—on the lower step throughout it is light and sandy, as if the more argillaceous of its components had been washed away: here it becomes at once stiff and clayey, more intracticable and less fertile than before. There is a very beautiful lake at the entrance of the village.

Palm trees, which had hitherto been in a great measure strangers, now began to reappear,—the Palmyra being the most plentiful (*Borassus flabelliformis*). One magnificent grove of these towering above the tamarinds, banians, and other round-topped trees, was peculiarly striking. Nearly all the wells here are more or less saline, with the exception of one of great depth some little way south of the lake. The steps and stone work leading to the lake on the side north of the public road are of a yellowish-brown coloured limestone, composed almost entirely of marine shells, a portion of the nummilite of Cutch, I imagine, found I was told on the margin of the Runn.

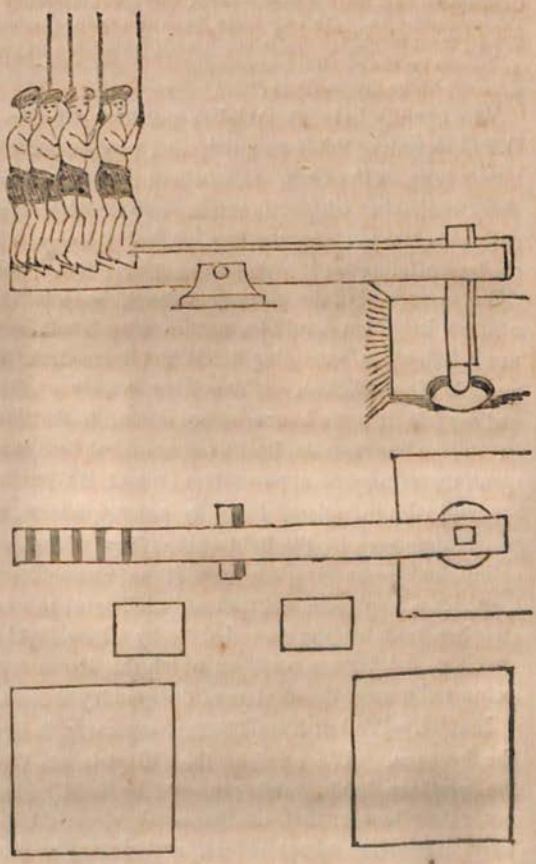
The place for travellers here is a large walled-in court or caravanserai, to which admission is given by a gate and archway. As it does not form a sleeping stage for Europeans, the accommodation intended for them is not very select.

Aclaiser is celebrated for its paper manufacture, and there are about forty paper mills in the village employing in all about 400 work people. These are generally paid by the piece—receiving so much for so many quires; each man being requited according to the skill and delicacy required of him. Some of them earn from 10 to 12 Rupees a-month, high wages for Goozerat. The paper is made from old gunny bags, waste hemp, broken cordage and

other long fibres, with small additions of spoiled cotton; but a very moderate allowance of this injures the strength of the goods.

"The mashing machine consists of a great wooden hammer, something like that of a fulling mill, only lighter—or that sometimes used for husking rice, or grinding charcoal for gunpowder. The accompanying diagram, rude as it is, will make this better understood than any description: it represents a native paper mill. The material to be pulped is thrown into a square stone vat, about three feet deep. In the bottom of this is a circular basin, with a roller-shaped piece of hard stone—commonly marble—on one side.

The hammer head diminishes in size towards the face, and makes a half grinding stroke against the stone. The shaft or arm of the hammer, so to speak, is about ten feet long—the fulcrum is about four feet and a half from the one extremity and five and a half from the other—on the shorter end it is flattened or divided into steps. Over this five or six persons stand each steadying himself by a rope depending from the roof on purpose. They tramp with one foot on the short end of the lever, throwing all their weight upon it and pushing it down by about six inches, the stroke at the other end being about 10 inches.



ELEVATION AND PLAN OF A NATIVE PAPER-MAKING MACHINE.

About a hundred strokes are made a minute, or nearly two per second: the hammer end of the lever weighs about 390lbs. In the case represented, the grandfather, father, and three children, constituted the gang of trampers. The rags are mashed in about three hours, and then thrown into vats adjoining, after which they are treated exactly as at home, with this difference, that the frame in place of being made of wire is of fine slips of bamboo, and thi is laid loosely on the frame itself, and is thrown out of it on the flannel with th

paper—from which it is afterwards removed. Native paper is much thicker, heavier, and more coarse, than that made at home : it is finished off by being glazed with a smooth stone. I have nowhere been able to find a published description of a native paper work, and am altogether ignorant of the statistics of the manufacture. As very little European paper is made use of in India,—China paper, from its cheapness, is much used for books, but it is too frail and tender for wrappers or the general purposes of correspondence, or the rolls into which native account-books are made up."

The country betwixt Aclaiser and Kem-Chokee is rough and uneven, deficient in water, thinly peopled, and very imperfectly cultivated. It slopes gently towards the Gulf. Here about twenty miles off, matters seem to mend shoreward,—in which direction trees and villages appear much more numerous than along the line of the highway. I have already mentioned the impossibility of bringing a canal from the Nerbudda in this direction,—from the aspect of the country I should greatly doubt whether the charges of canal irrigation could be met from such soil were there no more than the usual difficulties attending it. It had been dark for some hours before we reached Kem-Chokee,—a large dhurrumsala on the banks of the river Kem, and we left it some hours before dawn, so that little can be said regarding it. The Dhurrumsala itself is surrounded by a large high wall, enclosing a quadrangular space apparently of about 200 yards each way. It was surrounded with travellers, bullocks, camels, horses, and vehicles of all descriptions, when seen by the light of the fires, where some were watching, some eating, and some sleeping, the scene was sufficiently striking. The rest-house is a handsome convenient building at the corner of the square : the sleeping galleries are ascended to by a long flight of steps terminating on a spacious flat terrace roof, on which the house opens, and which seems to command a magnificent view of the country around.

Jan. 24.—We left Kem-Chokee very early, in hopes of getting to Surat in the forenoon. We reached the Taptee at Vireow, a large village on the northern bank, and crossed by boat. Both banks of the river are precipitous ; that on the north about 30 feet in height—the previous slope descending about 20 feet, and giving, so far as I could guess, the line of country betwixt the two rivers at about 20 miles from the sea, a general elevation of from 50 to 60 feet ; and though levels by the eye are fallacious, I feel confident that in this I am within the mark. From the southern side of the river I had a walk of four miles to Surat.

SURAT is supposed to be one of the oldest cities of Hindoostan. After the discovery of the passage by the Cape of Good Hope it was much frequented by ships from Europe : diamonds, pearls, ambergris, civet, musk, gold, silks, and above all cottons, being exported from it in abundance. Such was the

number of Moslem pilgrims that went from it to Mecca annually, that it was looked on as one of the great gates of the Holy City. In 1612 Captain Best received permission to establish an English Factory at Surat, and having effected this he left ten persons behind him to take charge of his property, valued at £4000. The Dutch established a factory here three years afterwards—the French about a century later. In 1664 Surat was attacked by the Marhattas under Sevajee: the Mogul governor took refuge in the castle —the inhabitants fled from the city altogether. The servants of the East India Company, with Sir George Oxenden at their head, shut themselves up in the factory and summoned the seamen from the ships close by to their aid: they strengthened their position, and made such a defence that the enemy found themselves compelled to withdraw. By this means Company's property to the value of £80,000 was saved, and the English received the thanks of the Mogul authorities for their bravery. Surat dates its decline from the acquisition of Bombay by the East India Company in 1668—the past half century has been the period of its most rapid decadence. The population was in 1798 estimated at 800,000—In 1817 it was estimated at 157,195—in 1825 it was supposed to contain 124,000 inhabitants, of whom 10,000 were Parsees.

In front of the eastern gate* is an even smooth expanse, in which the rich tenacious delta soil even in March retains some semblance of grass. Immediately at the base of the wall is a large open ditch—the course not infrequently of a torrent. The walls are of stone: they surround the whole city for a circuit of some six miles, forming a sort of semicircle, of which the Taptee is the chord. The wall is about twenty feet high, defended by semicircular towers, with lancet-shaped battlements, and very unserviceable looking gates. The stranger is at once struck with a peculiarity in the walls to provide against a class of contingencies to which Surat is proverbially liable—large sets of square holes or conduits to permit the water to pass through in case of floods.

The outer wall, Briggs tell us,† encloses a space called the refuge of the world: there is an inner wall built nearly parallel to the first, or at an interval of some forty to a hundred yards from it, called the refuge of the city and which is now in a state of extreme delapidation. On first entering the,

* This portion of the narrative is a reprint from the *Bombay Times* newspaper 1851, and gives an account of Surat as I had seen it in Feb. 1850.

† Cities of Gujrashtra, Part I, page 9. A very learned and elaborate work, which might have been most valuable but for the style, which renders it next to unreadable. It indicates a great amount of careful observation, and a very large extent of reading indeed on the part of the author.

outer gate (from the west) the visitor is struck with the fine airy drive, and picturesque line of trees in the space between the walls. Proceeding along the well-gravelled walk towards the Dutch factory, now the only place of reception for travellers, a handsome obelisk presents itself on the left, about twenty yards from the footpath, and near to the outer wall, which might at first sight naturally be supposed the monuments of some of the magnates of the country. The inscription runs as follows :—

This humble memorial
To the merits of a faithful and dutiful servant,
Sheik Dadoo,
Is erected by his late friend and Master,
E Roberts, Esq.,
As a token of sincere regret
For the loss of a faithful Friend and Servant.
He was unfortunately drowned in the Taptee,
On the 26th April, 1847.
Aged 17 years.
His body is interred near this Monument erected
To his Memory,

The mode Mr. Roberts has taken to testify his esteem for his domestic, is an unusual one, but were masters more frequently to discriminate betwixt the faults and failings and the merits of their servants, and to set aside what of the latter were due to their country, their tongue, or faith, deserving pity, and requiring caution rather than punishment, and make them aware how much their virtues were prized, and how sure they were of being rewarded, we might hear less than we do of misconduct of domestics, and think more than is customary of the duties of masters as well as servants.

The Taptee, as already stated, flows past immediately in front of the travellers' resting-place. It here makes a sudden flexure towards the town, and is rapidly eating away the bank from the Castle downwards : the bulwarks of wood, consisting of ponderous timbers and a heavy planking like a ship's side, have been loosened by the floods which have flowed over them and excavated the earth from behind, and they are tumbling piecemeal into the water : the banks, once deprived of their protection, must speedily be undermined, and unless some means are taken to divert the river from its present course, must soon come to destroy a large portion of the city. The bank here from the crest down to low water is 32 feet. There are several beautiful tamarind trees in front of the old factories,—one 12 feet in girth with a spread of 72 feet. From the sea to far above Surat, is a fine rich clay, the diluvium of the rocks above, deposited doubtless when the whole was under stagnant water—a few rounded stones, from the size of a pea to that of a walnut, are occasionally found in it, but they are rare, and consist mostly of nummulite limestone, with very perfect nummulites imbedded

in them. The walls of the Town and Castle are mostly built of a coarse variety of conglomerate, such as that prevailing around Gogo, and which constitutes the bone-containing rocks of Perim,—with here and there lage masses of laterite, a rock not to be found *in situ*, within some hundreds of miles of Surat, but which is seen in blocks and fragments scattered along the shores all the way north to Cambay : how it came to be so, is a mystery. The houses are mainly built of brick, and the bricks are about the worst made that can be imagined. They are about a foot in length and half as much across ; from the extreme irregularity of the lower surface their thickness can only be guessed at. The clay is of first-rate quality for brick and tile making were it somewhat less fusible, but no attempt is made at tempering or mixing it. The brick-maker squats beside the nearest watercourse, digs a hole a few feet square, and fills it with water, dashing the clay into the mould, which again is placed on any surface that is nearest, without the slightest preparation or selection. They are both made and burnt in the very centre of the town. The burning is as rude a process as can be resorted to. A large longitudinal hole is dug some three feet deep, thirty across or so, and one hundred and fifty in length. The bricks are placed endwise, leaning slightly backwards in this, along with the fuel, and the pile raised some two or three feet above the surface. The fuel consists of street sweepings, horse-litter, bones, the horns of sheep and oxen, putrid skins, or anything else that will burn : the smell given out when the whole is in a state of ignition, may be imagined. Lime is burnt in large conical heaps close by : the fuel is the same, but somewhat more carefully selected—the limestone is the kunkur found in the alluvium adjoining. Betwixt the natural fusibility of the soil and the want of control over the fire, and probably from the ammonia given out by the fuel, large masses of the bricks are melted, and in this form are found as the foundations of houses all over the town. From the frequency of fires in Surat one is at first inclined on seeing these to infer, that they have been fused during conflagrations—a more close examination shows them to be the refuse of the kiln. They sell for seven rupees per thousand, but when arches, vaults, or any tolerably fine work is desired to be constructed, they require so much mortar and such an amount of chipping and dressing, that really good bricks would be cheap at three times the price.

Surat is a singularly ugly town : the buildings are rude, mean, irregular, and ill-constructed : at no time could it ever have boasted of anything bearing the semblance of architecture—the Castle excepted. Structures unsightly from the first have been rendered doubly so by the appearance of squalor and decay attaching to nearly them all : the ravages of fire and flood are visible everywhere, and for scarcely a hundred yards on end are the walls of the

houses perpendicular. The clay on which they have been built has given way, and the foundations slipped during the inundation or the heat which ensued, and the walls cracked, twisted and warped in every imaginable direction,—nothing but the strong teak framing binding them together has saved them from destruction. The streets again have for the most part been so ploughed up by the floods, that many of them present the appearance much more of deep watercourses than thoroughfares, and there can be no doubt that in the former capacity they have proved much more serviceable than in the latter, there being few portions of Surat which are not once every four or five years at all events navigable by boats.

The Castle of Surat is a strong, compactly built, rather striking-looking structure, overhanging the river, having four stout round-towers with curtains between. A fine flight of steps descends right under the western wall, over which merchandize and military stores used to be carried up and brought down. Immediately under its guns, in days of yore, Indiamen and large merchant vessels and ships of war were wont to ride at anchor: now steamers of light draught of water and native craft of no great size can alone cross the bar or ascend the river. On the landward side, the Castle is little more than half the height it is towards the Taptee: here it presents us with on outer and an inner wall, a rampart, wet ditch, raveline and glacis, but no guns. Within the inner gate is a neat quadrangular court. The Fort Adjutant and Commander of the Artillery reside in one of the wings of the building: their accommodations are neat, airy and commodious, and from their great height, and being roofed with bombproof, or masses of brickwork so considered where there are no bombs to try them, are peculiarly cool. The view from the window is particularly fine, commanding in one direction the windings of the river upwards by the walls of the city, and in the other its beautiful reaches out to the sea.

The present castle was built in 1542, when Sultan Mahomed Shah reigned in Goozerat. When the Mogul Emperor of Delhi obtained dominion over the province shortly afterwards, the commandership of the Castle and government of the town were kept separate.* The King of Delhi maintained a fleet, for the protection of the seaboard of Western India: for the support of this three lakhs of rupees were annually drawn from Surat—the fleet itself fell latterly into the hands of the Siddees of Rajpore—so potent and flourishing shortly before our connection with it was the now decayed city of Surat, which threatens speedily to have its walls melted into the yellow waves of the Taptee.

* Extracts from the Memoirs of Jonathan Duncan regarding the History of Surat.—Papers presented to the House of Commons.

The native burying-ground is beyond the inner wall, at the further end of the city: graves are scattered about amongst the houses as if the inhabitants were indifferent even in this to Mahomedan usages. Here it is where the river, when swollen, first enters the city. The walls are for hundreds of feet together fairly undermined, and nearly ready to fall. The cause of the destructiveness of these floods is sufficiently obvious: the Taptee rising amidst steep rocky hills where rain falls with extreme violence, here makes on ordinary occasions a long bend like the letter C. round the city, and rises and rushes on with such rapidity and fury that it takes a short cut across the country and inundates Surat in its progress. In 1838 Captain Fulljames recommended that an open cut, the chord of the arch, should be made, to draw off the superfluous waters of the river, and the device for a time seemed to have succeeded: later floods have proved too much for it—and besides, the whole channel of the river is moving edgeways towards the city, and the water undermining the foundations of the walls. There seem at present no means of saving Surat from utter annihilation excepting by digging a new channel for the Taptee at a safe distance from the town, and in such fashion that it shall not from henceforth be able to quit its bed. Half the value of the property destroyed by inundations within the past half century would have completed all that was required: at present Surat, as just stated, is on the point of annihilation and the question is—is the cost of the cut equal to the value of the Town?

A list of the Floods from which Surat has suffered would form an interesting portion of the annals of the city; but in India scarcely anything worthy of being recorded is set down,—the memory of trifles is chiefly cherished, and the climate speedily effaces all the vestiges of even the most striking catastrophes. In 1810 both Broach and Surat appear to have been visited by inundations unusually disastrous, though infinitely less so than that which followed twelve years afterwards. In 1822 the Taptee, swollen by a long continuance of rain, began to rise on the 15th of September, and continued for three days to increase; the water advanced so rapidly that some gentlemen only saved their horses by taking them up-stairs. By this time the flood had risen four or five feet higher than it had ever done before, extending to the eaves of many of the lower-roomed houses. Nearly 300 yards of the outer wall of the city were washed away, two bridges were destroyed, part of the wall of the Adawlut was carried off, and 400 houses are reported to have fallen at Ramdier. About thirty lives were lost, and about 1400 head of cattle were swept away. 2000 houses in all were believed to have fallen, of which above 600 were substantially built. On the 6th of August 1835 another inundation is recorded. The water began about two o'clock in the

afternoon to overflow the Town: it was at first ascribed to an unusually high spring tide: by nine in the evening it had reached its height, and when the sun rose on the morning of the 7th, the whole city was under water, and boats plying in every direction: the country around looked like some vast inland sea. The water is said not to have risen so high by a couple of feet as during the previous inundation. For two days the inhabitants were unable to procure food—they were first supplied by the liberality of Ardaseer Bahadoor. About twenty people are supposed to have perished, and cattle innumerable were swept away; about 500 houses, chiefly in the lower part of the town, were destroyed. For two days previous to this a violent storm of wind and rain prevailed, by which many of the houses were unroofed. The loss sustained was estimated at from 25 to 30 lakhs of rupees. Two years after this another inundation visited the unfortunate city. It commenced on the 28th of August 1837,—it reached its greatest height next day, and remained for twenty-four hours nearly stationary. On the 31st, about 200 feet of the wall betwixt the Outwa and Majoora gates gave way with a tremendous crash, and the roadway in front of the breach was excavated to the depth of from twelve to fourteen feet, and completely washed away. The water rose above its average level about thirty-seven feet—some parts of the city were sixteen feet under water. The river, usually about a hundred yards across, extended to six miles in breadth. At some places it was more than double this. We are unable to give particulars of the floods of more recent occurrence. Surat is as famous for its fires as its floods. Our information in reference to the latter is still more defective than with regard to the former. Singularly enough 1822, 1834, and 1837, were years both of flood and conflagration. In April 1822, nearly 2000 houses were consumed by fire, and property to the extent of about £ 50,000 destroyed. On the 7th of March 1834 property to the value of fifteen thousand pounds, and about 200 houses, were destroyed in about three hours by conflagration. About three hundred houses are said to have been burnt down on the 6th of March 1836—property to the value of twenty thousand pounds having been destroyed. In April 1837 a fire broke out at Surat which lasted two days, and is said to have consumed about 5000 houses. The amount of property destroyed is not mentioned; but such was the misery that followed, that a subscription was set on foot, and above a lakh and a half of rupees in a few days collected. To this Sir Jamsetjee Jejeebhoy contributed £ 2,000, and Government £ 5,000.

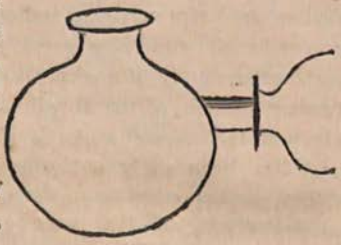
The Station Library deserves a particular notice, and one or two of the professions chiefly pursued by the inhabitants may be mentioned. The library was founded in 1821 by Dr Carr, Bishop of Bombay, and Mr Romer, and

is now the property of three natives. It is, as already stated, in the Dutch Factory, immediately adjoining the travellers' bungalow : the rooms, five in number, are extremely neat and commodious, and the books have obviously been selected with very great judgment and care. There is, indeed, a much better supply of works relating to Surat itself, than in the Library of the Bombay Branch of the Royal Asiatic Society. The supply of periodicals and the newer works is also good, though the bookbinder's department has been sadly neglected. One of the most valuable collections of this portion consists in the old newspaper files—a species of historical documents of the very greatest value in India, and which very rarely meet with the attention they deserve. At Surat they are lying scattered about unbound ; this notice will, we trust, induce the proprietors of the library to treat with more respect a collection which we venture to say is almost unique, and which tends more to throw light on the times to which they refer, than half the contents of their rooms. If the Station Library of Surat, one of the smallest military posts in the Presidency, is contrasted with that of Poona one of the largest, before it was broken up in 1850 to meet its liabilities, the reflections produced are anything but agreeable, and impress us with the conviction, that as the gaieties of the station extend, intellectual pursuits decline.

The three principal manufactures flourishing at Surat are distillation, paper-making, and turned work; silk and cotton weaving are still extensively practised, the former mostly by females : the simple loom of the oldest form is that universally in use, and the rate of remuneration seldom exceeds two or three annas a-day. A Parsee matron is often to be seen, with her children and their grandmother around her, all taking a share in the family task. For striped cotton cloth or gingham, twenty-four yards long and two feet wide, Rs. 1½ is paid in all ; of this six annas is allowed the weaver,—a sufficiently humble rate of compensation certainly. But the work is not heavy, and may be performed in the intervals of domestic occupation, and it always brings in something to the family. The dyers of Surat have long been famous ; and here that curious variety of calico-printing peculiar to India is practised with singular dexterity, which consists of tying up the cloth to be dyed in the strangest convolutions that can be conceived,—the knit portions remaining untouched by the dye which colours the rest.

DISTILLATION.—The still consists of a large earthen jar, of the shape of that used by water-carriers, but many times more capacious. The receiver is of the same form and material as the still, but somewhat less in size,—the former being two and a half, the latter one and a half, feet in diameter. The

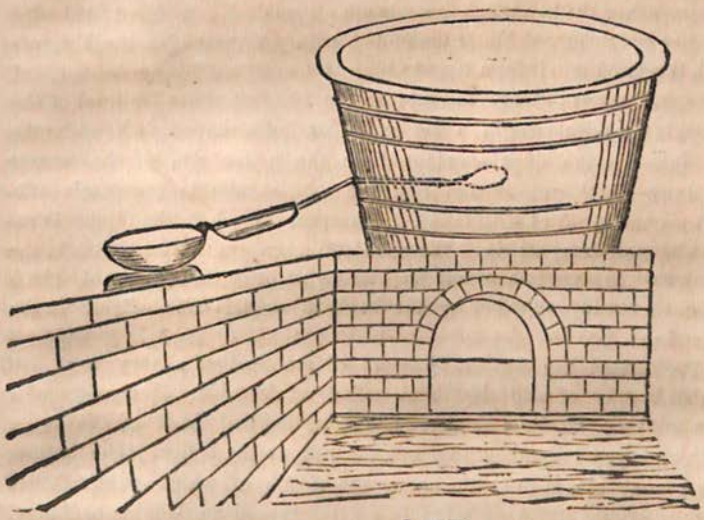
accompanying woodcut will at once explain all that requires to be known. The still-mouth is plugged up with a piece of wood luted with clay —a hole is cut in the side of the still near the top, and into this is fastened a wooden spout, which conveys the spirituous vapour to the cooler. This last stands on a tressle or frame of wood, placed over a pit for holding water, and cooling is effected by a man lifting successive fills of water from the well in a cocoanut ladle, and pouring it on the top of the cooler.



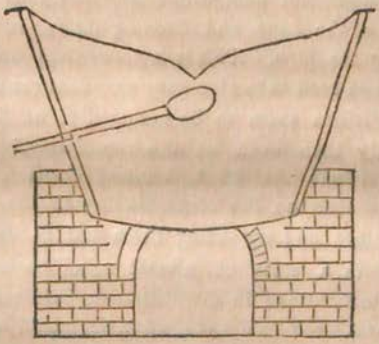
We have seen no case where a contrivance so simple as a vessel of water with a small spout or drip has been resorted to. A cocoanut tree will yield about four seers of toddy or sap a-day: seventy-five seers of toddy, or the produce for one day of eighteen cocoanut trees, furnish a charge for a still, and yield twenty-five seers of liquor on a first distillation—on the second it affords eight seers of liquor considerably under proof. Loose as this mode is of stating matters, I have not been able to make it more exact: I know of no author who furnishes information as to the quantity of sugar contained in toddy, and the amount of spirit of a given strength it ought to yield, and have not had leisure to determine these facts for myself,—a sad instance of the want of familiarity with the principles and details of the most common branches of industry prevailing around us. One thing seems certain, that the process of distillation just described is nearly as unskilful as can be, and that a third, if not a half, might be added to the returns were a little more care and attention bestowed on the matter. Date and Palmyra trees yield toddy as well as cocoanuts—I do not know in what quantity per tree, or of what strength. A strong liquor, called Mowrah, is in popular repute amongst the natives, especially the Parsees, in Western India. The following process is employed in making it at Surat. I have not seen any Mowrah stills at Bombay. The berries of the Mowrah are about the size and form of dates; they are first steeped or mashed in casks. So soon as they get into a state of active fermentation, the fermented liquor is drawn off and carried to the still, and more water poured over the berries, successive charges being added as long as the worts are strong enough to ferment. A sufficient number of casks, or mash-tuns as they may be called, are employed in the work so as to permit a charge of the still to be supplied on each drawing off from the fermenting tuns: as it takes a couple of days to complete the process

of fermentation, the worts already drawn off would sour were this to be waited for before that first run was run off.

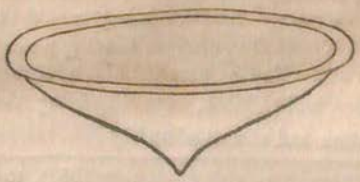
ELEVATION.



SECTION.



COPPER TOP.



The still consists of a wooden tub with a copper bottom built over a furnace of brickwork; over the mouth of this is placed a huge copper saucer, the centre of the bottom terminating in a nipple. This is placed over the mouth of the tub which contains the liquor, and is fitted tight after the still has been charged: it is then filled with cold water, a fresh supply of which is poured into it from time to time as the original fill gets heated. A bamboo spout passes through the side of the tub just above the level of the liquor inside—it terminates in a flat shovel or ladle-shaped dish under the nipple. Into this the spirit condensed on the under side of the saucer trickles down—it is run off and removed into a suitable receptacle outside. A second or third distillation is resorted to when the liquor is required to be made very strong. We have still more grounds here than in the preceding case to complain of our deplorable want of facts—a want which might be so readily supplied by the medical or scientific officers in the neighbourhood.

The Portuguese use for the purpose of rectification a very neat and serviceable variety of still, by them called an Alembic. It consists of a common cooking pot as a boiler, with a cylindrical head of the same diameter, and generally about the same depth as the boiler. The bottom of this is a cone closed in at the apex, the mouth of which covers that of the boiler. Around its inner edge is a slight turned-up ledging or flange, from which a pipe or worm leads off the spirit. The cylindrical portion of the top being filled with cold water, the spirituous vapour is condensed by it in this inside of the cone, and, tricking down, is caught by the flange and carried off by the pipe. This is a convenient and serviceable implement, and may be so used as to give very excellent results.

The Hooli festivities seem to be indulged in at Surat with a greater degree of brutality than even at the presidency.* On the day after the general uproar was concluded, hundreds of men and women mixed together might be seen on the steps leading to the river by the Castle, washing their clothes and spreading them out to dry, while they themselves remained in a state of almost primitive nudity. The women seemed longest to continue in Bacchanalian indulgences, and when the streets where almost free of nuisance, a female would now and then be seen to stagger out of some haunt adjoining, when younger females speedily collected around her, sousing her first with pails of water and then covering her with dirt from the streets,—the joke being reckoned equally good by all the parties sharing in it. At the principal landing place the scene was still more disgusting than at the Castle: here females of all ages, to all appearance grandmothers, mothers, and children, were disporting themselves in the river in a state of intoxication and almost of nudity.

* This refers to my previous visit (February 1855), the Hooli had not commenced—January 1855.

THE OLD BURYING GROUND—is by far the greatest marvel at Surat; the new one opened around the Protestant Church near the castle, I presume when the church was erected in 1825, is now almost exclusively employed for the purposes of sepulture. The old burying-grounds are just beyond the inner walls of the town, and those of the Dutch and English residents of former times closely adjoining each other, though the entrances to the two at opposite sides are a considerable way apart. On approaching either of these the stranger, from the aspect of the monuments, is led to suppose that this before him is a collection of Mahomedan mausoleums rather than of Christian tombs. The merchants, in the latter days of the contending factories, seem to have been as anxious to rival each other in the magnificence of the structures erected over their remains, as they were in life ambitious of competing in wealth and splendour. The most magnificent of the tombs in the English burying-ground is that of Sir Geo. Oxenden, president over the Company's affairs at Surat from 1662 till his death in 1669. On Bombay being made over by the Crown to the East India Company in 1666, he was appointed Governor of the Island, which at first constituted our sole dominions. He appears to have been a man of great determination and courage, and very high talent.*

There a reseveral other elaborate mosque-looking tombs of great elegance, but very much inferior to that just named. Besides these there are here a multitude of obelisks, pillars, and lesser monuments—many of them very handsome, with simpler tombstones of more modern date. The whole of the monuments are built of brick with marble slabs inserted for the inscription—the lesser and lighter of them, the obelisks in particular, present a most extraordinary appearance, from nearly all of them being many inches off the plumb, some indeed have bent over so much as to have tumbled down altogether.† The clay here is of almost unknown depth, and offers the most insecure of foundations. I copied the following inscriptions on some of the more notable :—

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* See Anderson's Western India,—Oxenden, p. 90-97.

† There seems altogether a singular want of uprightness about Surat: it is to be hoped that the failing does not extend itself into the moral world. The Castle flagstaff has, for four or five years, been 3 or 4 feet off the perpendicular,—a spectacle so offensive where the flag of England first floated in Western India, that it is surely discreditable to some one that no remedy has been provided for it where it might so easily be obtained.

Hic Jacit
SAMUEL EVANCE ANNESLEY
Honorabilis Viri
Samuelis Annesley, Angli—
Et Susannæ Uxoris, ejus, filius
Natus Martii 18 A. D. 1697—8.
Variolis corruptus eodem die An. 1702
Mortuis die 21.

Hic etiam jacit
Frater ejus CÆSAR ANNESLEY
Natus 8vo. May 1700
Morbo spasmi 30 July sequentis
Mortuus
Cum Duobuosa bortivis.

Here under lie the mortal remains of WM. WLKINS, Esq.
Late Collector and Magistrate of the Zillah of Broach,
In the *Bombay Civil Service*, who departed this life
On the 30th November 1820. Aged about 29 years.

As an Oriental scholar generally
The deceased was highly distinguished,
Having in early life acquired a taste
For the languages and literature of
The East, under the tuition of his
Uncle, the celebrated Orientalist
CHARLES WILKINS, LL. D.
His knowledge of the Sanscrit and
Persian languages was not excelled
By any of the Bombay establishment.
THIS MONUMENT
Has been erected out of regard
To the memory of *Mr. Wilkins*,
By a few of his Brother Servants.

Here Lyeth Interred
The body of
ELIZABETH WYCHE
Widow and Relict of
Bernard Wyche, Esquire
Chief for Affairs of the Hon'ble United
British Company. Surat Anno. 1712
She was
A dutiful Child
A virtuous good Wife
A Tender loving Mother and true Friend
Very Compassionate and Abundant
in works of Mercy and Charity.
Was born
On the Island of Bombay
And dyed
In Surat
About the LIV. Year of Her
Age on the XXX. day of June
Anno Domini MDCXXXVI.

Interrogas amice lector
Quid sibi vult grandior hæc structura responsum habe;
In hoc gloriabar satis quod alteram illam grandem continet
Superbit insuper quod una cum illa tegit generosos duos fratres
Fraterrimos
Qui et in vitis fuerunt et etiam in mortuis sunt conjunctissimi
Alterum velis nil ligas, lege alibi
Intelligas velis aut nescias lege hic
Dominus GEORGINO OXENDEN Baronettus
Filius natu tertius D. Jacobi Oxenden Equitis
Hujus provinciæ dignitate ornatus
Ad locum in India Persia Arabia præses

Insulæ Bombayensis Gubernator
Ab illustri Societate pro qua præsidebat et gubernabat
Ob maximam suam et re, eti a in eam merita
Singulari favoris et gratitudinis specimine honestatæ
Vir
Sanguinis splendore rerum usu
Fortitudine prudentia probitate
Preeminentissimus
Cum plurimorum luctu obit Julii 14°
Cum plurimorum frequentia sepultus est Julii 15°
Anno Domini 1669.
Anno Ætatis 50.
Heus Lector!
Ex magno hoc vivo vel mortuo aliquid proficias.

The second—

Hic situs est CHRISTOPHERUS OXENDEN plorati
Exemplum vita sed vitæ morte ea ducæ
Intrat et exit hic inceptis animamque finivivit
Ille dies tantum numerare tri..inta valebat
Neu annos, nam raptim exigit mors rationem
Quæritis o Domini qui I damni vel quid habetis
Lueri vos servum socium; nos perdidit ille
Vitam sed qui contra occi lat m rs mihi lucrum
Exiit e vita April 18, 1659.

Hic Jacet
BARTHOLOMEUS HARRIS ARMIGER
Propugnaculi et Insulæ
Bombayensis nuper Protectus
Et Pro Gubernatione et Societate
Mercatorum Londinensiane
Ad Indos Orientales Negotiantium
Surato Presidens
Et Conjux sua ARABELLA
Ino Maij Decimo
Anno { Etatis XLV.
Domini MDCXCIV.
Hæc Martij Vice Secundo
Anno. { Ætat XVIII. V
Domini MDCLXXXVI.

Hic Jacet BEN. GARY
Filius Unicus HENRICI GARY
Patris et MARIÆ Matris suæ qui
Hinc ami gravit a l eternis mansiones
19th Aug. Anno 1658
Anno Etatis 14.

Lo where this silent marble weeps
A Friend, a Wife, a Mother sleeps
A heart within whose sacred cell
The peaceful Virtue loved to dwell
Affection warm, and Faith sincere
And soft Humanity were Here
In agony in death Resigned
She felt the Wound she left behind
Her infant Image here below
Sits smiling on a Father's Woe;
Whom what awaits while Here she stays
Along this lonely Vale of Days
A Pang to sacred Sorrow dear
A Sigh, an unavailing Tear
Till Time shall every grief remove
With Life, with Memory and with Love
In Memory of GERALDINA JAMES
Wife of WILLIAM JAMES, Esq.
Of the Council of Surat. Who
Departed this life the Thirteenth day of September
1775, Aged Thirty-four years and seven month

Captain ALEXANDER FORBES, of the Bengal Army. Died at Surat, 16th February 1760. Æt. 32.

In memory of MARY PRICE, Wife of William Andrew Price, Esq., Chief for Affairs of the British Nation, And Governor of the Mogul's Castle and Fleet of Surat, who through the spotted veil of the small Pox, rendered a pure and unspotted soul to God, experiencing death, which ended her days April the Thirteenth, Anno Domini 1761. Ætatis suæ 23.
The virtues which in her short life were shewn
Have equalled been by few, surpassed by none.

To
The Memory of
WILL. ADAM PRICE, Esq.
Late Chief of Surat
Who departed this life
March 11, 1774
And also of
ELIZABETH, His Second Wife
Who survived him
Thirteen months

Under
This Tomb lies buried
The body of ANNE
The once loving and the beloved wife
of Mr. SAMUEL COURT
A Servant of the Hon'ble
East India Company
Who ended her life
The 16th November 1754
Aged 30 years.

She had great accomplishments
A generosity of mind
A behaviour engaging
Complaisance obliging
And the truest sense of gratitude
Scarce to be equalled
Her disconsolate Husband fully esteemed the peculiar
Felicity of his days, that he had such a Wife
So useful a Friend
And so agreeable a Companion.

Sacred
Beneath this tomb is interred the remains of
MATILDA
Eldest Daughter of
Colonel GEORGE BURGESS MORDEN
Of the Staff of the King's Army
Killed at the Assault of Morne Fortance
In the Island of St. Lucia, West Indies
Her afflicted Family bewails the loss
Of a tender and most affectionate member
Born 19th July 1796
And died at Surat on the 11th September 1820
Aged 30 years.

Here lies the Body of
DANIEL SETONE, Esquire
Late Chief Lieutenant Governor of Surat Castle
Who departed this life
the 17th April 1803
Aged 86 years
Thirty-five years in the Civil Service
of the Hon'ble
East India Company
Equally distinguished for his zeal
and unbending justice.

The Dutch burying-ground is less spacious than the English one, but is much more adorned with mausoleums, and several of these are greatly more handsome than even that of Oxenden himself. One of the finest fell during the rains of 1854, and the stability of many others seems sufficiently insecure. It surely is much to be lamented that relics of so much historic interest as the mausoleums of Surat, many of them of very considerable architectural merit, should be suffered to run into decay without an attempt being made to preserve them. I am not aware that anything de-

serving the name of a drawing, or so much as a photograph, exists to afford even the image, when the relics are gone, of the monuments by which the early merchant princes of England and Holland, in India, sought to perpetuate their names. A paper-maker had made use of the principal Dutch tomb to dry his paper, just out of the state of pulp, and I took the liberty of making free with some sheets of this, to obtain relief facsimiles of the more accessible inscriptions. The best of them were, I regret to say, afterwards destroyed on my arrival in Bombay, by an unwise attempt to obtain from them casts in stucco without the preliminary preparation they ought to have undergone; most of the others, through the damp of two monsoons, got spoiled before I had time to copy them.

The following furnishes a specimen :—

The Inscription.

HIER RUST
HET LICHAAM VAN
ZYN HOOG EDELHEYT
D. H.—*Hendrik Adriaan*
Baron Van Reede
TOT *Drakesteyn* HEERR VAN
Meydiegt
ONDER DE ORDRE VAN DE RIDDER
SCHAP EN UYT DE SELVE ORDRE
GECOMMITTEERD IN DE ORDINARIS
GEDEPUTEER DE VAN D'EDle MOGEND
HEEREN STAATEN S LANDS VAN
Utregt
COMMISSARIS VAN DE GENERALE
NEDERLANDER GEOCTROYEER DE
OOST INDISCHE COMPAG IE OVER
India
REPRESENTERENDE IN DIER QUALITE
DE VERGADERINGE DER EDle HREN
XVIIen
OVERLEDER DEN 15en DECEMBER
Ao 1691
OP't SCHIP DEGTERLANT ZYLENDE
VAN *Cochim* NAAR *Sourratta*
OP DE HOOGTE VAN DE ENGELSE
STERKTE *Bombai*;
OUD ONGEVAER
56 *Jaaren.*

BASTIANA THEODORA D'LE BOUCQ
Grenulinni van den E : E : Agtl : Heer
JAN SCHREUDER
Directeur en Opper Geluder
7 MAY 1743.

Surat, like many other places in India, has of late years been suffering from a calamity of a very singular nature and not easy to be explained. Nearly a third or fourth of the wells formerly pure, and which appear to draw their supplies by percolation from the river, have within the past twenty

years become brackish. The contaminating matter is, I am assured, sea salt; but it abounds in such quantities as to render the supplies affected by it unfit either for household purposes or for cultivation. Handsomely buil wells which must at one time have supplied the elegant gardens all around, and fitted up with expensive brick and lime conduits and reservoirs, are now to be met with everywhere wholly abandoned. At Surat the tide has an extreme rise of about eight feet opposite the old Factories, and very rapidly diminishes a little above the castle, where the river at low-water exhibits something almost like a stream. It is at no time more than brackish, and only very slightly so unless at springs. I could not learn that the wells rise and fall with the tide: they are nearly all under the river level, and probably communicate with it through the gravel bed I observed at Vareow, a little below highwater, or some lesser stratum of similar character. Yet at Bombay where they rise and fall regularly with the tide to the extent of upwards of a foot at springs, the quality of the water is in no way affected; and I know but one well in the Island, an old Portuguese one, formerly used for the gardens near Sewree Fort, that has become salinised, and this from a very obvious cause—the approach of the sea. In the North West Provinces the supply of water in the wells has of late years so alarmingly diminished that above 5000 have become unserviceable; but this through the deficiency, not the brackishness of the water.

REGUR, OR BLACK COTTON SOIL.—There are few things I was more anxious to examine for myself than the Regur, or Black Cotton Soil of Goozerat, a substance of such singular properties, and in reference to which such diversity of opinions have been expressed, that I should have considered my journey amply repaid had it done nothing more than enable me to inspect it for myself. Regur is thus described by Colonel Newbold:—

"The purest regur is usually of a deep bluish-black colour, or greenish, or dark greyish black, fracture varying from shining to earthy, streak brownish or greenish black, shining; when placed in water it crumbles slowly with emission of air bubbles, and forms a tenacious paste; when moistened it gives out an argillaceous odour. Before the blowpipe, *per se*, it melts into a greenish glass, or dark slag. Mr. Reid fused some of it in a large covered crucible placed in a furnace, into a solid mass, on the surface of which a crust of oxide of iron formed. A chemical analysis made by my friend Dr. Macleod afforded the following result:—

Silex	48	2
Alumina	20	3
Carbonate of lime	16	0
Carbonate of magnesia	10	2
Oxide of iron	1	0
Water and extractive	4	3
	100	0

The quantity of iron it appears by this analysis is not sufficient to account for the black colour of this soil, which may be partly attributed, as in the case of the Cuddapah limestone, to the extractive or vegetable matter it contains. The regur of Trichinopoly, I am informed by Captain Allardyce, does not fuse, and contains imbedded crystals of pure mineral carbon, which are converted before the blowpipe into a white ash. There is, no doubt, nearly as great a diversity of composition in the regur deposit, as we find in other equally extensive aqueous rocks.

The best kinds of this extraordinary soil are rarely suffered to lie fallow, except by accident, and never receive manure, which is even supposed to lessen its fertility. It has yielded annually, crop after crop for upwards of 2000 years (usually in triennial rotation) of cotton, juari, and wheat, or bajri, without receiving any aid from the hand of man, except an annual scratching with a small plough, and a decennial, or still more seldom, clearing of the nuth grass by means of the large plough. It is irrigated solely by the dews and rains of heaven.

The chemical composition of the cotton plant it produces, somewhat assimilates in its ingredients to that of the soil, as Dr. Macleod's analysis subjoined, shows. In addition will be found the alkali of the vegetable, and the muriate of soda, which as well as the carbonate, are frequent accidental ingredients in the composition of the regur. They sterilize it when present in large quantities. The proportion of silex in the cotton plant, as might naturally be expected, is much less, and the alumina is altogether wanting :—

Silex	7 0
Alumina	0 0
Carbonate of lime	45 6
Carbonate of magnesia	25 0
Charcoal, oxide of iron, and loss	5 2
Carbonate of potass	10 6
Muriate of potass and soda	6 6

The regur is remarkably retentive of moisture ; a property to which is ascribable *much of its fertility, since it has been ascertained by the experiments of Sir Humphry Davy, that the absorbent power of many soils with respect to atmospheric moisture are greatest in the most fertile soils.* He dried* 100 parts of a celebrated soil from Ormiston in East Lothian, by a heat amounting to 212° Fahrenheit, and found that by one hour's exposure to air saturated with moisture at a temperature of 62° it gained 18 grains. Dr. Christie thoroughly dried a portion of regur by a heat nearly sufficient to char paper. He then exposed to the atmosphere of a moderately damp apartment 2615·6 grains of it, and found after a few days it had gained 147·1 grains. He now exposed it to an atmosphere saturated with moisture, and found that the weight increased daily till the end of a few weeks, when it was found to be 2523·4 grains. The soil had therefore gained 212·3 grains, or about 8 per cent.

During the dry season, when the crops are off the ground, the surface of regur instead of presenting a sea of waving verdure, exhibits the black dreary aspect that the valley of the Nile puts on under similar circumstances, and which powerfully reminded me of the regur tracts of India. Contracting by the powerful heat of the sun, it is divided, like the surface of dried straw by countless and deep fissures, usually about the 1st August, between 9 and 10 A.M. While the surface for a few inches in depth is dried to an impalpable powder raised in clouds by the wind, and darkening the air, the lower portions of the deposit at the depth of eight or ten feet, still retain the character of a hard black clay, approaching a rock, and is so strictly does the drought have proved, has a temperature of 130°. In wet weather the surface is converted into a deep tenacious mud.

* Madras Journal of Literature and Science for october, 1836, p. 472.

Over the vast and fertile table lands where this soil prevails, rice, the staple article of food on the maritime and low tracts, is no longer, or but seldom, used by the lower classes, and cakes of wheaten flour, or of that of the juari and bajri are substituted.

The purest beds of regur contain few rolled pebbles of any kind ; the nodules of kunker we see imbedded have probably been formed by concretion from the infiltration of water charged with lime ; and it is only near the surface that the regur becomes intermingled with the recent alluvium of the surrounding country, or in its lower portions where it becomes intermingled with the debris of whetever rock it happens to rest on,—trap and calcedonies in trappean districts ; granite, sandstone, pisiform iron ore, and limestone, in the plutonic and diamond sandstone areas. It sometimes exhibits marks of stratification : in Gujarat, Professor Orlebar informs me the regur is distinctly stratified ; and a writer on the Geology of the Hydrabad country, in the Madras Literary Transactions, (Part 1, p. 82) observes, that the cotton soil there varies in depth from a few feet to many fathoms ; and that it is generally found distinctly arranged in strata, which are sometimes separated by thin layers of sand or gravel. These strata, he observes, vary in thickness ; they are sometimes horizontal ; in other instances waved, or more or less inclined to the horizon."—*Asiatic Transactions.*

With the accuracy of Captain Newbold's description of Regur, I agree, with the exception of the portion which refers to stratification. The appearance of layers in beds at first deceived me : on minute examination I found that these were rarely, if ever, horizontal ; that they never approached by well-defined lines of junction, but invariably shaded gently into each other :—the Regur of Goozerat is generally imagined as being a stratified formation, seldom exceeding 6 or 8 feet in depth, and thinning out at the lips all around. It shades insensibly into the lower soil, whatever that may be, and the mineral and stoney particles are common to both, following exactly the same arrangement whether in layers or beds,—clearly indicating that the one form of material was transformed from the other superimposed on it.

This state of matters is peculiarly conspicuous betwixt Surat and Kem-Chokee, and all along the banks of the Taptee. In some cases both soils abound, and equally so with little nodules of siliceous spar encrusted in chalcedony —such as are so abundant in our amygdaloids, and in others with small fragments of nummulite rock, and that this last is so little plentiful may be explained by the rapid solution of lime in all our soils, and its reappearance in the form of kunkur. Regur is remarkable for the abundance of this which it contains, and for the extraordinary rapidity with which it makes its appearance after having been in a great measure removed by the cultivator. It appears in all forms, and seems from portions the size of peas to slabs of several feet square. The great frailty of Regur is its tendency to become wet and spongy in excess of rain, and the great fissures with which it is traversed, varying from a few lines to three or four inches in width at the mouth, and often penetrating the soil to the depth of a couple of yards. All these phenomena exhibited on

the large scale by Nature, may be seen in miniature by spreading out a thin film of wet Regur on glass.*

The Regur of Goozerat, like the vast masses of earthy matter around, is obviously a portion of the vast marine alluvium derived from the abrasion of the rocks nearest adjoining the shores of the great primeval ocean, from the waters of which it was deposited. In the Deccan it is frequently found under exactly the same circumstances in the brown and yellow clay of the great Lacustrine formations, so unmistakeably characterized by the multitudes of fresh-water shells embedded in the calcareous strata found at the bottom of their beds. Immediately around Poona again, as also in Vehar valley in Salsette, it is found reposing immediately on the rock and intermingled with the river gravel and fragments of the trap around. Under all these varieties of circumstances its aspects are the same, and I have little

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* The following is a description of the singular Black Soil of Siberia, supposed by the Rev Mr Hyslop, (Bombay Asiatic Transactions, 1855,) but as it seems to me with ut any sufficient ground, identical with Regur :—

I. *Recent Formations.*—1st. Black soil, or Regur (in Marathi *Kanhira*) has yielded no organic remains to our imperfect researches, but I feel persuaded that those who are well supplied with apparatus will yet have the pleasure of detecting some microscopic animals in it. I have never been able to acquiesce in the now generally received theory that accounts for it by deposition in water. It seems far more probable that it is the product of luxuriant vegetation in a moist atmosphere, which has grown and decayed in the localities where it is found. This supposition would harmonise with all the appearances of stratification which it undoubtedly exhibits, and at the same time preserve its similarity to the *Tchornoi-zem* of Russia, which has lately been shewn by Ehrenberg† to contain several forms of *Polygastrica* and *Phytolitharia*. In the kunkur, which is mixed with the lower portion of the regur, bones are occasionally found ; but though they look ancient enough from the thick coating of lime with which they are encrusted, they do not appear to differ from the bones of the modern ox and sheep. Besides, I have never found such remains so far from the abode of men as to free me from the suspicion that they belonged to animals in a domestic state.

† "*Professor Ehrenberg.*—The Tchornoi Zem, or Black Earth of central Russia, covering more than 6 ,000 geographical square miles, and of extreme fertility, supporting more than 20,000,0 00 of sou s, and giving rise to an annual exportation of about 20,000,000 hectolitres (55,000,000 bushels) of cereals, was described by Sir R. I. Murchison in 1842,‡ and was considered by him to be a submarine deposit, accumulated in quiet water, and possibly of nearly the same age as the Loess of the Rhine. M. Ehrenberg, on examining the Black Earth under the microscope, found in it six forms of Polygastrica, and twenty-two of Phytolitharia; and concludes that it is not an aqueous deposit, but rather a soil formed of the debris of ancient forests—an origin hypothetically given§ to this peculiar formation by earlier observers.—*Quarterly Journal of the Geological Society*, vol. vii., No. 27, p. 112."

‡ Pro. Geol. Soc., vol. iii., pp. 712, *et. seq.* : and Geol. Russia, vol. i., p. 557

§ Loc. cit., p. 714.

doubt that its chemical constituents agree very closely with each other. Pity that with so many chemists amongst us a matter of such interest should be left to conjecture.

I returned to Bombay after an absence of twenty-seven days, from a journey to me very delightful, full of information and interest, and extending over a space of about 400 miles, in the highest health and vigour as I believed —only to be stricken down with a virulent jungle fever very nearly fatal. As I believe I owed this mostly to my own indiscretion, I may perhaps venture on a few hints for the benefit of other less grey-headed griffins, who like myself have failed to profit by the warnings or experience of others, and confident in their own strength and powers of endurance, defied a climate which no one can brave with impunity.

I had in the first place undertaken a tour throughout a country which did not even afford fowls or eggs, and where supplies could not be looked for, and had neglected to supply myself with provisions such as habit makes necessary to one considerably past his youth. I had abundance of rice, flour, and biscuits, tea, coffee and sugar, but neither wine nor beer, and such provinder is not at all sufficient for one accustomed to much more generous fare, when exposed to considerable ranges of heat and cold, and subjected to a large amount of fatigue or exertion. There is besides no reason why a traveller should endure more privations than are requisite, and not solace and strengthen himself on his journey with the creature comforts to which he is accustomed, provided this can be accomplished without hindering his progress, or increasing his charges. The maxims of the Duke of Wellington and Major Dugald Dalgetty should never be forgotten—that one of the most important considerations at the commencement of a march is—the state of the commissariat.

Tired of the day's occupation of the bullock cart, eminently comfortable as it was, I usually slept in such comfortless quarters as the Durrumsala—generally an open portico—supplied, sleeping on a charpoy at least a foot too short. Nothing could be more unwise, these places being always filthy, and to all appearance storehouses of malaria, and subject to the sudden chill of the morning-breeze. I do not think a traveller injured by any amount of exercise, short of that which feels positively distressing, which fevers him, or prevents him from sleep; walking through the sandy ground of Goozerat to the extent of probably 20 miles a-day, occasioned me, though entirely out of practice, no inconvenience; but nothing can be more dangerous than long exposure to the sun even when the feeling of heat is least oppressive, and

where no evil consequences arise at the time. The frame becomes essentially injured, and the mischief makes its appearance, it may be long afterwards, in some very formidable shape indeed.

A single journey into the interior is quite sufficient to explain the cause of the time taken in travelling through the country by those who, accustomed to home rules of speed, consider this mysterious. In Europe, a tolerable pedestrian may get over the ground at the rate of from 20 to 30 miles a day for weeks on end without inconvenience, seeing everything on his way worthy of being seen, filling his portfolio with drawings, his cannister with plants, or wallet with geological specimens. In India, scarcely half this can be accomplished. A pair of the best bullocks do not travel much above fifteen miles a-day, and the ordinary cattle are so slow that nothing is gained by hiring. Three and a-half miles an hour is about the highest rate of speed that can be looked for where there is scarcely anything deserving the name of road. People to whom the country is familiar, or who do not care much for seeing about them, perform their journeys in the dark. Where it is otherwise, the few hours in the morning and evening are all that can be made available. The heat of the day being nearly as fatal to sight seeing, where exposure to the sun risks a fever, or darkness itself.

The traveller really wishing to see the country, who strives to overcome these causes of delay will, in the majority of cases, find himself battling with impossibilities, or at all events fighting at such risk or sacrifice of health in a vain effort to economise time, that if wise he will give it up at once and adapt himself to circumstances which are the result of the necessities of climate. The hours spent in doors on the journey may always be profitably occupied in arranging and preparing for future use the facts being collected. The sum total of the time occupied by the journey and by journalising need not on the whole be much greater when the two are carried on together than if taken up separately, even were none of the risks just referred to in the way.

The idea so generally entertained that the Gulf of Cambay is rapidly silting up, receives no countenance from anything I was able to observe on the spot.

The soundings of recent surveys as compared with those of former years indicate no decrease of depth, and excepting during the monsoon the four great rivers which flow into the Gulf are singularly free from mud. Near the debouchures of these, large masses of silt are known to have accumulated within the century, and this is likely to go on at moderate distances from the

shore. The extent to which the Taptee has shoaled is singular.* During the existence of the English and Dutch Factories little more than a century ago, large ships were built at Surat, — the first-class merchantmen of these days, probably from 500 to 600 tons, anchored under the walls of the castle, and no complaints appear to have been made of the dangers or difficulties attendant on the ascent of the river. That the banks which constitute the bar and

* The following extract from a Journal of a Visit to Surat made in Feb. 1830, gives an account of the approach to Domus from the sea :—

"Some score of miles to the south of Domus, the delta of the Taptee begins, and the land becomes so flat as to be invisible at a distance of ten miles from the shore, and then the curious spectacle presents itself, of palm trees springing apparently from the surface of the sea. No land, or sign of land, appear anywhere,—but the tall cocoanut, in single trees or clumps, stands clear and distinct against the sky. The present bar is about ten miles from the actual debouchure of the Taptee : outside of this we anchored, and then pulled on shore in a boat. The appearance of the land is most delusive, and looks not one-third the distance off it actually is. For a time the sail is pleasant enough ; but by and bye the currents and cross-currents, with an ebbing tide of the river, come roaring down like a whirlpool, and sweep and whirl the boat about in all directions. Great black banks of mud or sand, like vast sea-monsters, begin to show their backs on the surface : first one or two appear at once—then others spring up before and behind and beside you, till uniting together they form long filthy looking spits of sludge and sand. The current now encreasing in strength, and the water decreasing in depth, the boatmen land and tow the vessel along; and in all likelihood the passengers must land a good couple of miles from the shore, and tread their way through heavy sandbanks, *and deep channels as they best can*. The banks near Domus are full of hollows and basins, of from a few feet to many yards in diameter. These are left full of water by the retiring tide : these open into the sea by narrow deep cuts through the sand, which continue to pour out their little torrents and mimic cataracts often till past low-water. At half-tide many of the banks appear from five to seven feet above the level of the sea : standing on the gunwale of a boat it is impossible to see over them. The barrier spit of sand at Domus running in a long line of sandy hillocks and low hummocks parallel with the shores is obviously the old bar of the Taptee when the delta was under water, and the sea probably extended at least as high up as the present site of Surat. There is a very considerable fishing village with fine groves of trees at Domus, and a number of handsome residences close by, the favorite hot-weather retreats of the wealthier European and Native residents of Surat. Till within these ten years, Surat was the station of a commodore, one or more armed vessels constantly cruizing, or being anchored, off the bar : the last incumbent was the late Captain Pepper, who died at Poona in August 1818 : he appears while here to have devoted some attention to the geological marvels in the neighbourhood—many of the finest Perim specimens in the British Museum are marked as presented by his daughter, Miss Pepper. The Commodore's bungalow is now desolate : it seems to have been a very comfortable place of abode, and is still kept in repair by Government, and taken care of by a not over-civil or attentive sepoy. A wall with a neat wooden railing surrounds the compound ; the flag staff is taunt and entire ; the gates are dropping from their hinges, and there are the remains of a shrubbery and flowers inside : one of the bungalows is

fill up the mouth of the river, have greatly increased, can no longer be a matter of doubt: the scouring energies of the stream seem at the same time to have greatly decreased, and these two, the former partly depending on the latter, which I am unable to explain, account for the diminution of the rise of the tide; the depth of the bed of the river and the influence of the sea-water having decreased together. For a state of matters so unfortunate it does not seem easy to devise a remedy. Deepening and straightening the channels of rivers by dredging have generally been found to increase both the velocity and the mass of the water which ascends them, and were the mouth of the Taptee near Domus kept thus narrow by break-waters, it seems not unlikely that the bar might in a few years be swept away.

Meanwhile trade and enterprize have fled Surat; and independently of these, the natural aptitude of Bombay for the purposes of commerce are so admirable, that had those of Surat not deteriorated, its functions as a commercial capital naturally ceased when it ceased to be the seat of Government and head-quarters of the Factory; and there seems no reason now why sums should be expended in the improvement of its own port, which might probably prove sufficient to unite by railway the original with the present seat of the British Government in Western India.

There is one peculiar charm in visiting the Mofussil familiar enough I have no doubt to those accustomed to travel: to me it was delightful in itself—doubly delightful because of its novelty and unexpectedness; the extreme kindness experienced everywhere alike from utter strangers or from friends. I must, I fear, abstain from naming those to whom I felt myself under particular obligations in this way in case of offending: they will not the less understand what I mean to express. On one occasion, on landing, I went by mistake into the quarters of a gentleman on sick leave, in place of the travellers' bungalow, and on discovering my error, apologised and was about to withdraw. This was not only not permitted, but I was detained as a guest. Subsequently on another part of my journey, I resolved to spend some

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getting into a state of delapidation, the other and principal one is clean, neat, and habitable; the outhouses, cookrooms, and servant's apartments are nearly in ruins: the whole presents that most deplorable of spectacles, a dwelling-house in the country long uninhabited, but not yet so much decayed as to sever it from living associations, or make us forget the home it long and till lately presented. Domus is almost isolated by a marsh and low grounds overflowed by the tide, which extend for a mile and more into the interior. The delta of the Taptee is here indifferently fertile, and very partially cultivated: it is obviously suffering from want of irrigation—water could bring it into the highest state of fertility. Cotton is grown in small quantities, and chillies otherwise, seem the principal produce along by the river. Surat is scarcely discernible till close by.

little time near the residence of the party referred to, when I received an invitation as from an old friend. It was one of which I was unable to avail myself, but I felt very gratefully the kindness intended an utter stranger. On another occasion I came across a camp in the wilderness, and conceiving that the occupant could give me some information that I desired, I sent in my card, I was not only immediately received with the most cordial hospitality, but my commissariat arrangements not having been considered the most judicious possible for the journey before me, I found my people provided without my knowledge so as to make up for deficiencies. After a long day's journey sometime after this, I again passed another domicile on my way to a rather unpromising rest house, and availed myself of a horseman of my Bhownuggur escort to send in my name. The goodman of the house, a distinguished public officer, was immediately in quest of me, and we continued for half an hour and until quite dark goose-chasing each other, till at length I found myself welcomed to a handsome dwelling-house abounding in all the elegancies of civilization, with dinner ready laid as if I had been looked for, and my quarters for the night or period of stay all duly arranged, by parties who had never seen me before, and to whom I had no introduction. The provision arrangements, in which certainly I could not compliment my own prudence, were always the first looked after. On one occasion, nearly the only one in which I had a formal introduction, I was visited immediately and asked to make the residence of the gentleman to whom I had been introduced my home, and on intimating that I must be off again next morning, and could not think of troubling them on so short a visit, a party was invited on the instant to meet me, and a pleasanter one I have rarely met. Next morning, long before the faintest streak of dawn, my friend was with me attended by a servant with the residue of the delicacies and substantialities of the previous day's feast, packed up with that neatness and skill which the kindness, consideration and care only to be looked for from the best of housewives. These matters may seem of small account: they are not felt to be such by a stranger on his first visit to the interior. And though the principal part of the gratification they confer arises from the sense of kindness unexpectedly received, it is no small enjoyment after spending three or four nights on end in filthy verandahs, sleeping on a charpoy at least a foot too short, and feeding on native bread and butter, boiled rice and vegetables, to have a good warm bath, a nice bedroom and dressing-room, elegantly furnished rooms to look at, and a good dinner, which seems far costlier and even more luxurious than it is; above all, to have an evening's rational conversation about

the country being traversed, to hear the music of a female voice, and be awoke in the morning by the sweetest of sounds : " the lisp of children, and their earliest words."

APPENDIX.

The following is a list of the Temperatures in detail as noted by Dinshaw, the companion of my journey, and interpreter and assistant observer —

(Observations on the Tour to Kattiawar and Guzerat.)

Surat, 3rd January 1855.....High water at 1, P. M.

Taptee water, Temperature 76·2
2·0
Corrected..... 74 2 } at 4½ P.M.

75·8
2·0
73·8 } Temperature at 21 ft. deep Corrected.

Surface of water Temperature. 74·5
2·1
Corrected. 72·5

Bottle No. 3. Surface water Temperature. 75·4
2 0
73·4

Bottle No. 4. and water 10 ft. 4 in. deep. Tem. 6 miles from Surat. 73·0
2·0
71·0

Landed at Gogo, 4th January..... 2 P. M. Barometer 30·145 Temperature. ..... 73·0
Bhowmuggur, 4th January..... 10 P. M. „ 0·60 „ ..... 60·0
„ 5th January ..... 6½ A. M.

	Temperature	Dew point.	Dry.	Wet bulb.
Dan. Hygrometer,.	66·0	43·0	55·0	50·0

Nessuru, 5th January..... ..... 3½ P. M. Barometer. 30 000. Temperature 82·0
Wulleh, 5th January..... 9½ P. M. „ 29·970. „ 69·2
Wulleh, 6th January..... 6½ A. M. „ ·970. „ 59·2

Temperature in the open sky, 54·0

Dry, 58·0 Wet, 52·0

6th January A. M. Barometer 30·022. Temperature 62·8.

Ranpoor, 6th January..... 7½ A. M. Barometer.... 30·0·8 Temperature.... 55·8
Choora, 8th January .... 1½ P. M. „ ... 29·7·8 „ ... 7· 8

Dry, 77·7. Wet, 60 5.

Kharva, 8th January..... 8½ P. M. Barometer... 29·934. Temperature... 71·0
„ 9t January..... 6 A. M. „ ... ·972. „ ... 70·0
Wudwan, 9th January..... .... 8 P. M. „ ... 30·104. „ ... 67·0

Dry, 67·0 Wet, 61·5.

Wudwan, 10th January .... 9½ A. M. Barometer... 30·070. „ ... 70 5

Dry, 73·3 Wet, 61·5

Wudwan Well, No. 1, Water 20 feet deep and 10 feet from the surface of the ground to the water (¼ mile S. W. of Wudwan.)

At 40 minutes past one o'clock. Temperature of the surface water ..... 77·0
2·0
75·0

And at 18 feet deep, Temperature.....	73·0	2nd Experiment, Temperature	73·0
	2·0		2·0
	71·0		71·6

Well No. 2, Temperature 83·0 corrected, water 5 feet deep and 15 feet from the ground to the surface of water.

Well No. 3, Temperature	81·0 corrected.	Water 8 feet deep and 15 feet	Do. do. do.
Well No. 4, Temperature	83·0 „	„ 3 feet deep and 13 feet	Do. do. do.
Well No. 5, Temperature	82·0 „	„ 2 feet deep and 16 feet	Do. do. do.

Wudwan well, No. 6, Temperature 69·0. Water 6 feet deep and 30 feet from the top to the surface of the water (Gate 11 feet wide, length of the well 22 3 feet, breadth 22 feet.

Well No. 7, Temperature 69 0, deepest water 42 feet ; 1st pit 5 feet deep, dimensions 19 feet, 7in. by 16 feet ; from the top to the surface of water, 21 feet ; length of the well 129 feet ; breadth 18 feet 4 in.

Wudwan, 10th January .....8½ P. M. Barometer 30·086 Temperature..... 63 0

Dry, 63·5 Wet, 53·4.

Kaira, 26th January, Banian Tree, girth 31 feet 8 in., spread of the tree from N. to S. 138 feet, (one hundred and thirty-eight feet.)

Baroda, 19th January.—Bungalow well, Temperature 71·0, water 11 feet deep, and 10 feet from the ground to the surface of water.

Well No. 2. (Bazar) Temp. 80·0; water 13 ft. deep and 35 ft. from the ground to the surface.
Well No. 3. ..... 78·0; „ 1 ft. deep and 38 ft. from the ground.
Well No. 4. ..... 80 0; „ 10 ft. deep and 32 ft. from the ground.

The following is a set of observations on the Bombay Wells for the corresponding month of the following year: for this I am indebted to Mr. Fergusson:—

Experimental Observations on the Temperature of the Spring Water at the bottom of the Observatory Well, 1856.

Month and Date.	At about 6 A. M. Temperature. Water.	Air.	Difference from Air.	About 4 P. M. Temperature Water.	Air.	Difference from Air.	Remarks.
	°	°	°	°	°		
23 February..	78·0	76·0	+2 0	79 3	82·0	—2·7	
24..... „	77·9	74·6	+3·3	79·4	80·4	—1·0	
25..... „	...	...	...	...	...	...	The well is 38 feet deep, with a seven feet Wall round it above the ground. The spring yields about a foot of water a-day, the diameter of the well being seven feet. The spring is getting daily weaker, and will shortly be exhausted.
26..... „	77·8	73·4	+4·4	78·9	79·8	—0·9	
27..... „	77·7	73·3	+4·4	79·9	79·9	—1·0	
28..... „	77·4	73·3	+4·1	79·8	81·4	—2 6	
29..... „	77·2	72·2	+5·0	78·8	81·7	—2·9	

The above experimental Observations on the Temperature of spring water at a depth of 3 feet from the surface of the ground, as taken at the Observatory, Colaba, during the week and

ing the 29th February 1856, shew that, in the early morning before sunrise the water is warmer than the air, but at 4 o'clock in the afternoon, (or the hot part of the day) the water is cooler than the air.

The mean difference of the temperature of the water from the temperature of the air (in the shade,) deduced from a whole week's observations is :—

+ 3·87° at early morning and 1·85° in the afternoon. The range of these differences is 5·72,° but the actual daily range of the temperature of the water itself is only 1·35°—shewing thereby, that at the depth of 38 feet from the surface of the earth the temperature was nearly uniform night and day, and that the temperature was only 2° above English summer heat.

I have withheld the observations made on the temperature and saltness of the Taptee, originally intended to have been published. I have never yet had leisure to examine the specimens of water from the various rivers flowing into the Gulf and the different parts of the Gulf itself, and should I ever overtake this, may give the results in the form of a separate paper.

General Remarks.

Geology.—With the exception of the Bone-bearing tertiaries at Perim and Gogo—the Traps around Bhownuggur—the Seienite (which, as already stated, I have no means of examining) near Wullee, and the sandstones (supposed tertiary) at Wudwan, I did not fall in with a single specimen of rock *in situ* during my whole journey of nearly 400 miles; for at least 300 I was travelling wholly over an unfathomed alluvium. Of the rocks, nearly all that requires to be said has been so already. The huge mass of clayey matter met with in Goozerat altogether bewilders the European geologist.

There are few things we miss more in India on the surface of the earth than our tills and transported boulder stones and glacial formations,—the whole of those things in fact ascribed to glacier and iceberg action, which solve so many things formerly deemed *mysterious*. In India we find *nothing* but light alluvium, sand, or fine gravel, transported no farther or more forcibly than river action and the agency of moderate water currents will explain. But how came our huge clay formations in India into existence, and by what agencies were they modified into their present forms? The wells in Goozerat are from 30 to 40 feet in depth. Some of the banks of the Nerbudda are 70 feet in elevation, with no appearance of rock, and though we are not warranted in drawing any very definite conclusion as to how much further we might require to go before reaching rock, from the total absence of stoney masses even where the rains have at times torn up river beds to a depth of 20 or 30 feet below the customary channel, it may not be too much to conjecture, that

it is at least 30 feet below any depths hitherto penetrated. We need not, however, venture on any guess. The facts as observed disclose masses of alluvium that astonish us. In Kattiawar, from Gogo round to Bhownuggur, and from this again along by Wullee and Wudwan, and so across the Runn as far as Dolka, the soil is comparatively light and sandy—not much given to deep-rutting where roads exist, or to be grooved out into ravines by torrents. The river banks are nowhere more than from 6 to 10 feet in height—the gravel filling the bottom of the channel being apparently from a deeper scour or scarping out. I was not able to perceive any greater trace of stratification than might be accounted for by an occasional change in the course of the stream when the old gravel beds rose, and in many cases were cemented together by the infiltration of limewater, into a species of concrete or conglomerate. To the north-eastward of Wudwan matters begin to change: the soil becomes more argillaceous in texture, and lighter and more yellow in colour, with occasional patches of the Regur, or true black cotton soil, extending to the depth of a few feet only, and which, as has already been shewn, is merely a variety of the yellow, or brown soil transformed. The gravel and sand in the rivers up to this time consist either of trappean minerals and small portions of rounded trap or particles of abraded sandstone. The clayey soil further on contained scarcely any solid particles whatever. The banks of the Taptee and Mahae shewed clear indications of well-defined stratification, though not by any means to the extent that might be supposed from the appearance presented by them to the eye at a distance. The gradual changes in the soil from the surface downwards often affording the semblance of stratification, where a more careful examination shews that none exists,—a circumstance strikingly characteristic of the black soil itself.

The delta and the banks of the Nerbudda is entirely silt from the surface all the way down to the channel of the river, and there are at least three well defined beds of sand. The upper portion of the alluvium splits up into well-marked flakes from ¼ to ½ of an inch in thickness, which can be separated without trouble with the knife. The same is the case to a considerable extent with the Taptee both above and I believe indeed under and around Surat, there is a bed of trap-sand from three to four inches in thickness all along about 10 feet below the present surface of the country. Familiar as we are in India with the enormous masses of earthy matter that accumulate *in situ*, and which are obviously derived from the decomposition of the rock below, so as to be in no way startled by almost any amount of soft earth, without assuming aqueous deposit or transportation; and it is quite clear that the clay soils of Goozerat have all been

piled up beneath the surface of comparatively tranquil water: that in reality they are old marine formations of unknown geological date. The extent to which water in India, about the close of the rainy season, becomes impregnated with fixed air, occasions such a rapid solution of all calcareous matter, especially in the fine attenuated form of shells, that we have in a few years all traces of organic remains such as might guide us obliterated, unless where these are preserved by kunkerous concretions;—and these at all times are most worthy of being subjected to the most careful and unremitting attention. The town of Broach itself is built on an eminence of the same apparent structure as the country around, and this would lead us to believe in the operation of extensive denudations which have removed from 30 to 40 feet of soil, from some cause or other, leaving this single eminence at its original level.

From Broach across the Nerbudda towards Surat, and so all along by the seashore, and again a considerable way up the estuary of the Taptee, we have beautifully distinct evidences of two independent upheavals—the lower one probably corresponding to those along the shores of India on both sides from Bombay all around, such as have already been referred to in treating of the supposed submergence of Wullee (see p 34.) I am not conscious of having met with anything around Bombay—to which my experience is very nearly confined—corresponding to the second, or third shelf; I should think it more than likely that similar appearances might be met with near the mouths of the Mahae and Sabermuttee, though I had no means of determining the fact. Conspicuous amongst the contents in the gravel of the Nerbudda are small particles of the agates and cornelians found in such profusion in the Rajpeepla range of hills, a little way up the river: the appearance of these, shining like rubies in the sun, is singularly beautiful. The waters of all the four great rivers which discharge themselves into the Gulf of Cambay are, excepting in floods, pure as crystal, tolerably free apparently of all soluble matter, and bearing scarcely one particle of earthy contamination along with them. Viewed from the crests of their high banks they seem a bright clear cerulean blue,—the reflection of the sky above; to those in the habit mostly of observing wooded rivers, and looking at them from near the line of their margin where the objects on the banks are chiefly reflected, and not the sky itself, the appearance seems singular. The Nile and Ganges, so far as I know, are at all seasons contaminated by clay for many miles up from the sea.

In many parts of Kattiawar the surface of the soil was covered with an efflorescence of saline matter, apparently nitrate of lime, and here considerable quantities of nitre are occasionally manufactured from the soil

Notes on Certain Discoloured Appearances met with on the Surface of the Sea in Warm Latitudes.—By Dr. G. Buist, Bombay.*

[Read March 1856.]

It is one of the numberless agreeable results to which the pursuit of physical science has led us, that it has, to a considerable extent, dispelled the unpleasant impressions which long prevailed as to the credibility of the writers of ancient times when treating of unusual natural appearances. The flames seen to tip the helmets and spears of warriors, the contests visible in the clouds, the showers of fire and showers of blood, the statues of the deities which descended from heaven, the seas of milk and seas of flame,—all at one time supposed phantoms of the imagination and proofs of the mendacity or credulity of those who described them,—are now recognized as perfectly authentic and intelligible things, the only matter untrue in the writings of antiquity regarding them being the theory of their origin.

Descriptions long contemned as fabulous, are now found in most cases to be remarkable for their fidelity, and a wise man instead of throwing aside, as formerly would have been done, a statement as incredible merely because it was old or extraordinary, will assume at the outset that it is in all likelihood substantially true, and endeavour to discover its explanation or find its parallel in modern times. If, in the present age, we avoid the errors of the ancients, of ascribing marvellous phenomena to special interpositions or miraculous causes, we are sometimes given to accept a singular fact as established without making any attempt to ascertain its cause at all; and in nothing is this more remarkably the case, than in reference to the luminous appearances and the extraordinary discolourations so frequently to be met with in certain regions of the sea. These are allowed to be nearly all of animal origin: in some cases they are supposed to be caused by the spawn of fishes, in others by that of moluscous animals, and in the majority by animalcules or those singular varieties of Algæ, the Protococcus nivalis and Hematococcus. But when we have got thus far in our explanations we have hitherto rested content; no inquiry has been made and no explanation attempted to be offered, of what may be the nature or origin of the spawn or form of the animalcules, and our various manuals of observation or instructions for inquirers, when they call attention to most other things, seem to ignore these as unworthy of notice.

I am not at present prepared to do anything to dispel the pervading darkness. I have very frequently met with discoloured portions of the ocean

* A portion of this paper appeared in the *Nautical Magazine*, 1st May 1854.

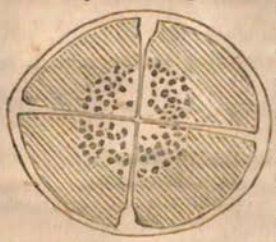
such as those referred to, in my voyages betwixt Bombay and Suez and back again, and the following notices which I have made or collected on the subject may probably be of interest.

The best of all observations are those made on the spot, on sea-water fresh drawn and with the objects to be examined still alive, were it not that it rarely happens that instruments of sufficient power are available for the purpose on a voyage, and the flutter and confusion of a passenger-ship are eminently unfavourable for study of any description, especially where quietness and tranquility are required.* There are besides many persons competent to collect and preserve specimens, altogether unqualified to examine or describe them, and, if the first of these tasks is performed by them carefully, the second may be left to the hands of others.

The region in which these singular appearances, as will be seen from the subjoined extracts are mostly to be met with, is the lower part of the Red Sea, but more especially off the mouth of the Persian Gulf, betwixt the 55th and 60th meridians and the 10th and 16th parallels.

In sailing over a sea of the deepest azure few things are more striking to a stranger than to find the ship, which just before had been rushing through the profoundest blue, traversing what seems a sheet of blood; for in most cases nothing can surpass the intensity of the redness of the water, and the margins of the coloured space are well defined, sharp, and abrupt. In cases where the colour is very intense, I have seldom seen it extend over an area of more than a few hundred yards in diameter, but the occasions on which I have met with it at all have not been numerous. In general the red tint is very much diluted, and I have seen the sea in and around Bombay Harbour for miles together faintly tinged with red. The following description of the creature by which this is brought to pass, when seen by the microscope, is given by Dr. Carter of Bombay :—

"They are subglobular, compressed vertically, convex above, concave beneath, and consist of a transparent coriaceous envelope, within which there is a mass of blood red and transparent granules suspended in a greenish coloured gelatinous substance, and divided crucially into four compartments by transparent interstices terminating at the circumference in notches, which are deepest at the sides. The blood-red granules are disposed around the centre in a circular form, within which is a transparent area, so that under a low magnifying



* The vibration occasioned by the motion of a steamer can easily be got rid of by placing the microscope on a cushion or on the folds of a mat, so that there is no difficulty worth naming required in this particular department to be surmounted.

power they appear like a central nucleus. In progression this *infusorium* becomes slightly elongated or lozenge-shaped, obtuse posteriorly and most deeply notched at the side. It has no appearance of celia; its movements through the water are rapid and waddling, frequently turning over and momentarily altering its shape, wheeling about in circles or advancing in straight lines, never retrograde, in length it is the 860th part of an inch, and the diameter of its transparent and red granules does not exceed the 18,000th part of an inch. When dead it assumes a subglobular shape and turns green."

I commence with the following somewhat lengthy extract translated from the *Annales des Sciences Naturelles*, 1855:—

"*Memoir on the Animalculæ and other Organic bodies which give a red colour to the Sea.*

"Navigators often meet at Sea with large patches of the water of a colour different from the ordinary colour of the sea, and these patches are seen in the form of bands, and in all the intermediate shades between yellow, blood-red, and brown. They are often of very great extent, and are separated at their edges distinctly and abruptly from the clear water beside them. They have been frequently taken for shoals, although they have almost always been seen in those parts where the water is of considerable depth.

It has been long known that this colour does not appertain to the water itself, but is produced by substances held in suspension in it; the nature of these substances has, however, been generally misunderstood. It is a common belief among seamen that it is the fry of fish. Naturalists who have had opportunities of examining these phenomena have thought, and correctly, that they are organic bodies, but having but seldom good micro-copes with them they have been unable to *determine with precision the nature of these bodies.*

Having had an opportunity the beginning of last year of examining a case of this kind, I was desirous of making myself acquainted with the various facts on the same subject related by navigators and naturalists. I have collected more than fifty of these relations. The comparative examination of all these observations has enabled me to determine in many instances with certainty, and in most of the others with considerable probability, the nature of these various organic bodies which produce this colour in the water. It has moreover led me to a conclusion which appears to me to interest physical geography as well as natural history itself; and this is, that these colorations are, for the most part, permanent in certain localities, where they are reproduced generally at the same time of the year. This will be clearly shown from the special examination of each particular case where these colorations have been observed. To make this study the easier, I have classed these observations according to the certain or probable nature of the cause which produced them.

Water coloured by various species of the small microscopic Algæ called *Trichodesmium*.

Do.	by the *Cetochilus Australis*.	Do.	by the *Biphores*.
Do.	do. *Greinotes*.	Do.	do. *Protococcus*.
Do.	do. *Noctilinques*.	Do.	by animals not yet known.
Do.	do. *Bacillaires*.		

And other colorations the nature of which are still unknown, but probably caused by matter carried into the sea from Rivers.

An observation made by Mr. Ehrenberg regarding the first forementioned coloring matter was at Tor in the Red Sea, as follows:—

"The 17th Decr. 1823.—I saw the surprising phenomenon of the water of the whole bay which forms the Port of this town coloured of a blood red. The water

outside of the coral reefs preserved its ordinary colour. The small waves of this tranquil sea bore to the shore during the heat of the day a mucilaginous matter of a blood-red colour, and deposited it on the sands, so that in the space of half an hour all the bay at high water was bordered with a red band several feet in width. I took up some of the water in glasses and carried it to a tent I had near the sea. It was easy to discover that this coloration was caused by small flakes barely visible, which were of a greenish colour, sometimes of a deep vivid green, but for the most part of a deep red, the water they floated in being perfectly colourless. I observed too that during the day these flakes remained on the surface of the water in the glasses and that in the night, and when I shook the glasses they went to the bottom and sometime afterwards would mount again to the surface."

About 20 years after this Mr. Dupont observed this phenomenon in the Red Sea also :—

"The 15th July 1843 we were abreast of the town of Cosseir; the sea was red the whole day, and the next day also till noon, at which time we found ourselves off Tor. During this interval the Packet had been going 8 knots an hour and had run a distance of 256 miles. Mr. Dupont collected some of this colouring matter on a strainer, and Mr. Montagne discovered in this substance the same characteristics of the plant discovered by M. Ehrenberg. These observations made with the greatest care possible leave no doubt about the results arrived at."

From Cook's first voyage :—

"9th Decr. 1763 We observed the sea covered with large bands of a yellowish colour, several of which were a mile long and 300 or 400 yards broad. We drew up some of this coloured water and found that it was filled with an innumerable multitude of atoms each terminating in a point, and of a yellowish colour. None of them were longer than $\frac{1}{24}$ of an inch On examining them through the microscope they appeared to be bundles or fasces of little fibres interlaced with each other, and resembling a good deal the *Vidus* of these Aquatic flies called *Caddices* Messrs. Banks and Solander could not make out whether they were animal or vegetable substances, or what could be their origin, or what they could be designed for. We had seen the same phenomenon before when we first made the coast of South America."

Kotzebue in his first voyage round the world relates the following :—

"The 6th Decr. 1815 we were in the neighbourhood of Cape Frio, of which I had, according to my instructions, to determine the latitude but as the continued bad weather there rendered this observation impossible, we directed our course to the Island of St Catherine. The next day we observed on the surface of the sea a waving band of a dark brown colour about 2 fathoms broad and extending in length as far as we could see. At the first sight of this phenomenon I took it for a shoal. We lowered a boat and Mr. Wormskiold went in it and brought on board some of this coloured water, and we found that the colour was caused by myriads of small crabs, and the seeds of a plant which our naturalists think grows at the bottom of the sea. This observation, very imperfect as to results, was completed satisfactorily by the two naturalists of the expedition, Eschscholtz and Adelbert de Chamiso. The 7th Dec. off the Brazil coast we sailed across a long yellow band some fathoms in breadth. We drew up some of the water in a bucket, and observed that the colour was produced by a vast quantity of very small thin yellow filaments about $\frac{1}{24}$ of an inch long With the microscope we saw a number of transverse lines in each of these filaments Two days afterwards we saw similarly coloured bands in the sea. On the 10th we sighted the Brazil coast."

This last observation is remarkable in many respects, the more so as being made not by seamen but by able and experienced naturalists. The observations indicate that there are bands of coloured water not far from Rio Janeiro.

Mr. Darwin has observed a phenomenon of the same kind in the neighbourhood of the Abrolhos Islands.

"The 18th March 1832, we sailed from Bahia. Some days afterwards being near the Abrolhos Islands, my attention was drawn to a reddish brown colour in the sea. The whole surface was covered with Animalculæ, which appeared, through a glass of no great power, to resemble hay cut into small pieces, the ends of which were ragged and indented. One of the largest of these small ships was found to be $\frac{1}{50}$ of an inch long, and the $\frac{1}{800}$ of an inch thick. On examining them with more care I found that each of these was formed by the union of from 20 to 60 cylindrical filaments, blunt at both ends, and divided at regular intervals by transverse partitions, between which was enclosed a flaky matter of a brownish green. The filaments are doubtless enveloped in a gluticous substance as they stick together without exactly touching each other. They are like small conferva, or hair-weed, forming a bundle or fasces of from 20 to 60 filaments. Their number appears infinite. The ship crossed several bands of this colour, which were about 10 yards broad and 2½ miles long.

Mr. Hind in the 'Sulphur' in Feb. 1836 in 9° south and 37° west collected also some examples of this plant, when he found that it exhaled an odour like hay when cut. On comparing these observations the result is, that there exists off the East coast of South America three bands of coloured water, viz. one off Pernambuco (Mr. Hind), another off the Abrolhos Islands, (Mr. Darwin) and the third off Rio Janeiro (Bougainville, Cook and Kotzebue). All these observations have been made nearly at the same time of the year, which in the southern Hemisphere is the warm season.

Mr. Hind in April 1837 found the same plant near St Salvador on the west coast of California, in 11° north. The odour from it was much stronger than that off the Abrolhos Island, strong enough to produce on several of the passengers as well as Mr Hind, a pretty strong irritation on the pituitary membrane, M. O'NEILL DARBEE —*Annales des Sciences Naturelles*, Paris 1855.

The following is from the Journal of the Bengal Asiatic Society for 1854, vol. xvi. p. 383, (Proceedings:)—

"*Ship Hashemy. May* 21*st*, 1846.

In Lat. 37° 42′ South Long. 25° 48′ East, being on board the barque *Hashemy* bound from London to Madras, we fell in with the following phenomenon in the sea, which perhaps may prove of some interest to you.

On the 17th of April in the above Lat and Long. about 9 hrs. 45 min (civil time) P. M. the surface of the sea became covered with what appeared to be a thick foam of sparkling white appearance. This continued, being at intervals more or less bright and sparkling till near midnight. It seemed to exist in large patches over the sea, and when the appearance was at its height the passage of the vessel through it seemed to be compared to nothing else than if it were being borne through beds of driven snow.

During the phenomenon the Barometer was depressed $\frac{1}{10}$ of an inch, and a thick black cloud hung over the vessel, which circumstance will, I think, indicate the presence of a large body of electricity in the atmosphere. I should likewise mention that the wind, which for two days had been very light, indeed at times almost calm, three quarters of an hour before the first appearance shifted from N. N. E. into N. W, from which quarter it blew a steady breeze till morning, when it died away into a light air.

On the afternoon of the same day several persons had perceived, and actually talked about, a dry kind of sulphurous smell in the atmosphere, wondering from

whence it could proceed; was it not possible then that as the appearance was very much that of a gaseous vapour rising through the water, it might have been the effect of some submarine Volcano, the foaming appearance being caused by the fumes of sulphur rising through the water?

I had a bucketfull of the water drawn up, some of which I put in a tumbler and tasted. It had a very bright sparkling appearance as of the purest spring water, but I could not discern any difference in its taste from common sea water.

In looking over Horsburgh's work I perceive that vessels have occasionally fallen in with a similar appearance, though if I could judge from his account on a smaller scale. Surely it must have been something of this sort which vessels have mistaken for shoal water even when they could obtain no soundings. Hence the Telemachus Shoal, and many others whose existence appears very doubtful.

Knowing the interest the Marine Board take in circumstances of this kind, I trust the extraordinary and interesting nature of this phenomenon may be sufficient apology, for the liberty one who is about to enter another profession of a very different nature now takes in addressing you.

I remain, &c.,

(Signed) Geo. F. Pearson.

Cadet of Infantry,
Madras Presidency

Palavaram, May 27th 1846.

In most cases the tint of discolouration is milk white, yellowish white, brownish yellow, or yellowish brown, and in this condition I have seen it extend for ten, twenty, or thirty miles; wherever it prevails the sea seems to become suddenly smooth, all spray and ripple disappearing, even should a brisk breeze be blowing. For the most part, however, the discolourations are met with in thick, dull, muggy weather, when there is scarcely any wind —such, at least, are the conditions under which it has been my fortune to meet with them.

The following extract is taken from the *Colombo Observer*, in reference to these singular appearances in the sea, observed off the shores of Ceylon in 1844 and again in 1851:—

"Those who frequent the Galle Face may have, of late, perceived at different places, a few yards from shore, large patches floating of an oily brown appearance which exhale a disagreeable odour to the passing breeze. They always appear about the beginning or middle of the S. W. Monsoon. On the coast of India the accumulation of this substance is so great that for a long distance to seaward the ocean appears to be covered with a huge expanse of oil, and the smell becomes so putrescent as to lead to the supposition that the carcases of dead whales or the dead spawn of myriads of fish had caused it. This is, however, a mistake, as it is nothing other than a vegetable production called conferva, a vegetable filamentary body, which makes its appearance on fresh and salt water at certain periods. The following note from a valuable work on the vegetable kingdom extracted from the former *Ceylon Herald* of the 14th May, 1841, shows that the appearance of these confervas is not unusual in Ceylon.

"'The sea to the southwards of Colombo, and more lately opposite. teh fort itself, has presented a very uncommon appearance for some days past. Instead of its usual brightness the surface has been, to a considerable extent, covered with what appears to the naked eye a sort of nasty froth or scum emiting a fetid smell. In the morning, when it has been usually calm, this scum has presented itself in broad belts and fields, and by the afternoon, after being exposed to the sea breeze, it is broken down into streaks lying in the direction of the wind, which, if it blow pretty fresh, disperses it altogether. We have examined some of this unusual substance in a tumbler of salt water, and were not a little surprised to find, that while it floated on the surface in the form of a scum, some parts of a yellowish green and some of a purplish brown colour, it tinged the whole water of a beautiful violet. We afterwards found that the whole water in the bucket in which it was brought from the sea had acquired the same colour; and indeed, it appeared to us the other day, when it was very abundant, as if the sea itself had been stained of this beautiful tint. We found, on minute inspection, that it consisted of an infinite multitude of small spindle-shaped bodies, each of which in its turn was a bundle of small threads joined but unbranched and seemingly very brittle, We have no doubt but it is a vegetable production in the sea something similar to the green substance which covers stagnant pools of fresh water. The most remarkable and unpleasant feature is its fœtid odour. When we read in voyages, however, of ships sailing for so many hours through seas of a bloodcolour and similar wonders, we are apt to suppose the author is taking the liberty of a traveller, but witnessing such a phenomenon as this is calculated to prepare us for giving them more credit. We are also glad to think that we have now an accomplished and indeed a most distinguished botanist in office in the island, who will, no doubt, be able to inform us accurately respecting the nature of such productions and on botanical matters generally. It says not a little for the interest of our island in the eyes of European botanists, that a situation at present so indifferent as Superintendent of the garden at Peradenia should have attracted such an accomplished traveller and discoverer of new plants as Professor Gardner, to whom we alluded in our last issue.'—May 14th, 1844.

"These confervas have, at the same time, at one period of their existence, something of an animal nature, which may account for the fœtor attending the masses floating about, as they have the power at one time, it appears, of moving about from place to place independently of the action of the wind and waves. As the subject is interesting, we shall, in our next, give some information on this matter."

The following extracts are from a journal of a voyage round the globe by D. F. Bennett, published in the Transactions of the Royal Geographical Society of London, 1837:—

"In lat. 19° N., long. 107° W., about half way betwixt the Gulf of Revila Gigedo, on the continent of America, a remarkable milk-white and luminous appearance of the sea was observed at midnight all round as far as the eye could reach from the mast-head, and which lasted until daylight Nothing could be detected in the water to account for it, nor could any soundings be obtained."

For the following extracts from the log of the H. C. Steamer *Atalanta*, from Aden to Vingorla, I am indebted to Lieut. Constable :—

"17th January, 1850.—Lat. 15° N., long. 63° E., 7 a. m.—Observed the water to have a luminous appearance. 9 a. m.—The sea of a turbid chalky colour. 10 a. m.—The sea assumed its natural appearance.

"18th Jan.—1 a.m.—The sea assumed a luminous appearance and continued so till 3 a. m."—There is no remark on the subject during the daytime.

"19th Jan.—1 a.m.—The sea gradually became of a dark chalky colour, inclining to milky. An intense haze all round, so that it was impossible to see ten miles off.

"3rd Feb., 1850.—Lat 10° 50 N, long. 6° 20 E., 7 p. m.—The sea had a similar appearance to what it has now assumed on passing across from Vingorla to Aden on the 17th Jan, at 9 p m, and so on till the 19th, till 2 a. m, betwixt lat. 15° and 14° 30 N., and long. 63° 50 to 56° 50 E."

It will from this almost appear, that for more than a fortnight the sea betwixt India and Aden had been thus discoloured for a distance of three or four hundred miles from north to south, and nearly as much from east to west, and as many vessels must have passed through the discoloured surface it would be highly interesting to obtain extracts from their logs, and should any of those who commanded them observe these remarks, they may perhaps supply the notices that are required.

The officers of the *Atalanta* state, that the luminous appearances observed in crossing in January from Vingorla to Aden, were accompanied by dense fogs and heavy masses of grey cloud all over the sky.

On their return voyage from Aden to Vingorla on the other hand, there was no fog, but the sky was entirely concealed by murky black clouds and there was every appearance of bad weather. Although in the coldest part of the season the air felt close and oppressive, the temperature of the sea was two degrees hotter than that of the atmosphere. There was a perceptible smell similar to that given out by spawn in calm hot weather.

The 15th January and 15th February happened to be two of the dates when those singular disturbances which make their appearance all over India, and perhaps indeed all around the world almost simultaneously, may be looked for; and accordingly, on turning to my journal, I find the following entries at the dates referred to by the *Atalanta*:

"17th January.—Fine soft morning. A perfectly dead calm till 1 p. m.; the sea breeze then sprung up from N. W. and immediately blew somewhat freshly; curious little cirro cumuli with long grey mare's tails in the S. E.; the barometer falling. At sunset fine cirri all over the sky, the current in the upper air from the S. W. almost right in the teeth of the breeze.

"18th.—Night perfectly still. Curious mist in the sky all over the morning. The sea breeze light and late in setting in; died away at sunset.

"19th.—A singular thin mist in the morning, with very heavy dew. Showery looking clouds in the east. A fine halo round the moon a little after sunset.

This state of matters had been preceded by considerable falls of rain in N. W. Provinces betwixt the 10th and 15th. On the 12th, Calcutta was visited by a severe north-wester. There had been considerable rain and storm again in the end of January. On the 5th of February, one of the most violent gales of wind that had been experienced for years passed over the north of Europe.

The following are the entries from my journal of this date :—

"February 4th.—The character of the weather all at once completely changed. The eastern sky covered with dense clouds. The temperature suddenly rose by nearly 10°, from 83° to 93° at noon.

"5th.—Soft misty morning, the heat most oppressive. Clouds all around the horizon with appearance of rain. A damp west wind set in just after sunset. Weather very squally to the northward.

In central India there was a heavy shower of rain on the 1st, and a thunder storm on the 6th. On the 7th, 8th and 9th the thermometer rose at Bombay to 91° and 95° at the coldest part of the whole season, a temperature rarely reached by it in the hottest portion of the heats.

At Aden at both the dates the weather was showery and irregular.

August 22nd, 1832.—Lat. 16° N., long. 59°35 E. At 7·15 p. m. observed the water to become quickly discoloured and of a very white luminous appearance, the sea considerably foamed and smoothed down, having all the appearance of a shoal water over a coral and sandy bottom. Observed the same occurrence both in the *Nautilus* brig and *Elphinstone* schooner on previous years when in the same vicinity.

The following extracts were published some years since in the Transactions of the Bombay Geographical Society; but the work is so little known in this country that they will probably be new to most readers. The first extract obviously refers to what has just been noticed :—

"*A Remarkable Appearance in the Indian Seas; in a Letter from Lieut. Dawson. Communicated by William Newnham, Esq.*

I beg leave to lay before the meeting an extract from the private journal of Lieut. Henry Dawson, a very intelligent officer of the Royal Navy, at present employed on civil duties with the Indian Navy at Bombay, containing an account of a very extraordinary phenomenon which was observed on the passage from Bombay to the Persian Gulf (the southern passage) on board the H. C. sloop of war *Clive*, in 1832. On my first going to India I was in the habit of intimacy with the late Capt. David Seton, who was many years resident at Muscat, and I well remember hearing him relate the circumstance of falling in with the *white sea*, described by Mr. Dawson, on

his occasional voyages to Muscat during the period of the S.W. monsoon.* So many years, however, have since elapsed, I am unable to give any more detail of the circumstance related by that officer, and merely here allude to it in proof of the phenomenon having been before observed.

WILLIAM NEWNHAM."

During a passage from Bombay to the Persian Gulf, on board the H.C sloop *Clive*, on the 22nd August, 1832, at a quarter before eight o'clock at night, a phenomenon appeared of the following nature, and to all on board of an unheard-of kind, which gave rise to transitory feelings of apprehension as to the vessel's contiguity to danger. Sailing under double-reefed topsails and fore sail at the rate of nine and a half miles per hour, before a strong S W. moonson wind and a high sea, without any indication of a change in the elements, the ship was surrounded *instanter* by water as white as milk or snow; it seemed to have no termination until it reached an altitude of 75° or 80°, where it subsided in a strongly-marked ecliptic, above which the heavens presented a beautiful and bright blueish cast, not dissimilar to polished steel. No line of horizon was visible; the dead white colour of the water close to the ship as it increased in distance from her very gradually brightened, until, where I supposed the horizon to be, it assumed a silvery aspect, which increasing as it ascended became brilliant and dazzling towards the zenith, obscuring the stars and clouds which had before this visitation been distinctly visible. The sea in a moment became smooth, the ship, from rolling and labouring considerably, quite steady; no diminution in the wind occurred, but a sensation that it had fallen even to a calm was general, but momentary. The delusion was occasioned by the instantaneous steadiness of the vessel, as well as the cessation of the previous noise from the lashing of a mountainous and confused sea against the vessel's sides and on her decks; her progress through the sea, however closely scrutinized, could not be observed; the disturbed water alongside and in her wake, as well as the foam around her bows, did not contrast with the adjoining unagitated fluid, notwithstanding from the velocity of the ship through the water these must have been considerable. Not a particle of phosphoric matter was once observable, either in the surrounding ocean or in the water immediately displaced by the ship's passage through it; but when taken up in a bucket and agitated with the hand, such was visible, but not in a greater proportion than is usual, nor did the water vary in appearance from common sea water; nothing could be perceived to attribute this strange phenomenon to.

Animalcules of a minute kind were perceptible, as likewise a few pieces of a glutinous substance of a purple colour, but neither in any considerable quantity, nor differing from what is usually found in the seas of the Indian Ocean.

We sailed the distance of fifteen miles without the slightest change in the appearance of the sea or sky, when in a moment this extraordinary phenomenon vanished, the ship at the same instant encountering the like high and turbulent sea as previous to her envelopment.

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* Our subsequent inquiries serve to confirm the statement, inasmuch as few navigations appear to have passed along the eastern coast of Arabia in the months of June, July and August, without noticing the discolouration of the water, but of a very slight character, and which, on examination when brought on board, is said to exhibit no difference whatever from sea water in other parts of the ocean.—ED. *Journal As. Soc.*

The ship was not within one hundred miles of the eastern coast of Arabia, or of soundings, but sailing in what is termed deep ocean water.

I have before mentioned that the ship was quite steady during her progress through the white water; this was the case, with the exception that in a few instances she gave a heavy roll as if influenced by a following swell; these were not more frequent than once in a quarter of an hour. Latitude 21° 40 N., long. 59° 40 E.; therm. 87°, bar. 29. 09.

The phenomenon I have attempted to describe appeared twice after we were first extricated from it, for periods of about twenty minutes; its brilliancy as well as influence over the waves as previously described; the transition from high and mountainous seas to a smooth and seemingly quiet ocean, and change again to turbulence, was as sudden as a flash of lightning.

On my arrival at Muscat, a few days after, I endeavoured to gain some information on the foregoing matter; but beyond finding that the phenomenon was occasionally met during the strength of the S W. monsoon, about the limit noted, and that the water was then *quite fresh*, I could ascertain nothing satisfactory. My informants were the Nakodas, or captains of H.H. the Imaum's ships of war, who frequently navigate between Muscat and Zanzibar, consequently must pass about the spot the *Clive* met what I have related. The Arab captains were firm in their assertion in the particulars of the fresh water, although they confessed that they had never tasted it. I did, as also the surgeon of the vessel, and, as I mentioned before, it did not vary in any way from ordinary sea-water.—*Journal of the Royal Asiatic Society.*

The following is the extract from the Bombay Geographical Society's Transactions in reference to the appearance seen in 1849:—

"Moozuffer, 25th January, 1849.—I cannot permit this opportunity to pass by without describing to you, in the best way I am able, a most extraordinary phenomenon which we all witnessed on the night of the 23rd instant. It would indeed require a far abler and more scientific pen than mine to do justice to it—however, I hope you will take the will for the deed, and pardon all imperfections.

At 6·30 p. m. observed a very remarkable milky appearance in the water, the colour assuming the same tint as a shallow mud-bank or sand bank. The sea, which had, a few minutes before, been turbulent and confused, suddenly became smooth and placid, and the air felt cold and chilly. In the space of an hour the whole verge of the horizon, as far as the eye could reach, was most brilliantly illuminated. The vessel shortly after entered a vast body of water of the most dazzling brightness, and of highly phosphorescent nature; in fact it looked as if we were sailing over a boundless plain of snow, or a sea of quicksilver. The surface of the ocean for miles in extent was unbroken—not a wave or ripple disturbed it, and the waters seemed so dense and solid, that the *Moozuffer* actually appeared as if she was forcing her way through molten lead. That part of the surface which was broken by the stroke of our huge paddle-wheels resembled small patches of thick milk or cream. The sky and everything around us was quite lighted up by it.

The weather was peculiarly fine, though the atmosphere was damp and moist: the wind was light from the N W., stars overhead clear and light, but those of a lesser altitude were rendered dim by a haze. The horizon nearly the whole time was dark and ill defined; a few thin cumuli, floating very low down, occasionally swept past; but no other peculiarity in the

atmosphere could be perceived until about ten o'clock, when a singular light was seen in the heavens to the northward, as if day was dawning or the full moon was either setting or just rising. It strongly resembled a faint Aurora Borealis, being of a roseate tinge near the horizon, and was a steady fixed light, but without those corruscations which are usually observed in the higher latitudes. It extended along the horizon in the form of a segment of a circle from N.W. to N.E., and the altitude of the centre of the arch was 15°. It continued visible until a few minutes after midnight, when it disappeared as suddenly as it appeared, and the sea about the same period lost also its luminous quality. The light in the heavens and the lightness of the sea were, however, again seen for about ten minutes at 2 a.m., when both became once more invisible. The horizon, except where the light appeared, was everywhere dark and indistinct, and could not be made out: the sky and sea were apparently blended together. The phenomena was altogether as beautiful as it was extraordinary. I could have stood on the deck gazing at it the whole night, and should not have felt fatigued. There was something grand and sublime in such a scene as I have faintly endeavoured to pourtray. No language of mine could ever do justice to it.

We were upwards of six hours in passing through this vast body of luminous water, and during that time we ran a distance of upwards of forty miles. Our lat. on first entering it was 16° 13 S., and long. 61° 51 E., so that our position was exactly abreast of the entrance to the Persian Gulf, and in the fair channel to the Red Sea. From the fact of our having seen immense quantities of sea-weed floating past whilst in this luminous water, I should conclude the accumulation of this and other decayed matter, whether vegetable or animalculæ, was the sole cause of this phosphorescent appearance; and that all this matter might have been swept out of those narrow seas by strong currents which meet no doubt about this spot: and I am still more inclined to believe this is the case, as a luminous stream of water has often been noticed nearly in the same lat. and long. and about the same season of the year. I saw it once in the *Victoria* when I commanded her, in the month of January, 1842, whilst on our voyage from Aden to Bombay; but the sea was not nearly so bright then as this time. The colour of the water so strongly resembled a shoal that I stopped the engines, and took several casts of the lead but could get no bottom with eighty fathoms of line. Several buckets of water were drawn up by Dr. Wilson, of the *Mozaffer*, but nothing whatever could be seen. It seemed as clear as crystal: on taking a bottle of it, however, in the dark, it became highly phosphorescent, giving out a strong light. It was full of animalculæ: some were in the shape of most minute globules of gelatinous substance, and others were not unlike small worms about an inch in length and about the size of a fine hair. On removing the bottle to the light, the animalculæ became instantly invisible. The light seen in the heavens I cannot account for, unless it was the low fleecy clouds which hung on the very edge of the horizon that reflected back the brightness of the sea, but why the whole sky should not have assumed the same appearance, I cannot imagine. It continued to shine in one spot only, and disappeared at the same time the sea lost its luminancy. I send you an extract of the log, in which the luminous appearance in the sea and heavens is noticed:—'At 6·30 p.m., passing through an illuminated sea: the sea also became suddenly smooth, with quantities of sea-weed floating by. At 10 a.

extraordinary luminous appearance to the northward, as that of a full moon rising or setting : the water of a thick white ; with a very dark horizon : wind N. W.—hazy blue sky, with passing clouds.' "

In all likelihood the luminous appearance in the sky described by Captain Kempthorne was merely the reflection by the clouds of the light from the sea.

Some months since I received from Dr. Haines an account of this as witnessed from on board the *Maria Soames* on her way from the Persian Gulf, lat. 21° N., long. 42° E.

"In May 1840, when about one-third across from Aden to Bombay, the aspect of the sea suddenly changed upon us, and at once seemed as if oil had been poured upon its surface. It was still as a mill-pond, and of a brownish soapy hue. The water on being examined was full of little fibrils—like horse-hair cut across—in lengths of the tenth of an inch or so. A wine-glass full of it contained hundreds of them. They were, to all appearance spawn or creatures of some sort in an embryotic state. I kept them for days in hopes that they would develope themselves, and drew up fresh specimens of the water so long as it remained discoloured. But no symptoms of life were manifest, and decomposition speedily ensued. In the dark they were not luminous. We sailed through them for about five hours, so that they probably extended over a surface of 500 miles:—what myriads of living things were there! The officers of the ship told us that similar appearances were not unusual : and that one much more remarkable than this was sometimes to be observed, when the sea seemed for hundreds of square miles white and milky, so that it was at times difficult to believe that the vessel was not on the point of getting aground."

In November the ship *John Line* came on a large sheet of discoloured water in the Eastern seas, supposed to be a shoal : the following is an extract from her log :—

"November 19th, 1849.—At 3 p. m, suddenly came across a large patch of discoloured water (ship at the time running 9½ knots with a heavy sea on) Hauled out E.S.E. and ran along the eastern edge until 2·15 p. m., when the edge trended off to the W.N.W. in a spit. The reef appeared to extend as far as was visible from the topsail yard in a W.S.W. direction, and from four to five miles S.S.E and N.N.W., and the current setting very strong to the westward over it. There was apparently broken water on the S.E. spit. I had no soundings where the ship was, and it blew too fresh and with too high a sea running for me to lower a boat to sound on the reef, the edge of which was perfectly defined, from the deep blue of no soundings to a dirty green. When off the S.E. end, the lat. was 12° 52 N. and long. by mean of three chronometers, 109° 46 17 E.—Cape Varella W. by N, fifteen miles, but not in sight from the thickness of the weather.—Extract from the log of the *John Line*.

The appearance described as seen from on board the *John Line* so closely resembles those already treated of, that I think we might almost hesitate admitting the certainty of the shoal until more proof of its existence reached us, considering that it must have been so often passed for a century or more without having hitherto been observed.

We have a variety of animalculæ which at certain seasons frequent our shores, imparting to the water in shallow pools, where they chiefly abound, the tint of blood: the exuviæ of this minute creature are found in abundance in the rock salt on the Indus and in the salt range. It tinges the back-water surrounding our salt pans, the depth of the hue being considered a sign that the brine is strong enough for being run into the pan. Under a glass of moderate power they are seen in a state of great activity before the salt crystallizes: these once embedded in the salt seem on re-dissolving it to be motionless. On a recent voyage to Kurrachee, I found off the shores of Kattiawar, where the general colour of the sea was of the deepest blue, large patches of the most intense red, apparently some fifty or sixty feet square—they looked like fresh-drawn blood, as if some monster of the deep had just been slain there We did not get near enough any one of them to draw a bucket of water, but have no doubt that they were occasioned by the same animalculæ which visit our shores. May it not have been from appearances such as these that the Red Sea has derived its name rather than from its corals, to which it is ascribed, which are usually white and seem greenish through the water, and are without a tint of red.

I must not here omit to note a curious incident which occurred at Pore Bunder on the 3rd November, of which the following account is given by a correspondent of the *Telegraph and Courier*: I am altogether unable to determine to what class of phenomena it is to be assigned.

"Pore Bunder, 3rd November, 1849.—We were visited with an epidemic amongst the fish a few days ago, caused I think by some submarine eruption of mud, mephitic gas, &c. The colour of the sea water on Saturday evening last, the 20th October, was changed from its usual tint to a deep red, emitting a most foul smell: the fish speedily were all destroyed, and were washed upon the beach in large quantities. The eruption must, I conclude, have been in the vicinity of the place, for many fish were taken alive, apparently stupified. The sea retained its peculiar colour until the 1st instant. I hear that the epidemic extended upwards of forty miles down the coast, and I am told that a similar phenomenon occurred three or four years ago, the natives attributing the death of the fish to a star having fallen into the water. The Geographical Society would do well to examine into the affair. I think the idea of a submarine disturbance is much more rational than that of the falling star. I have no means of telling whether there was any atmospherical disturbance at the same time: we had, however, no sea breeze on the 28th or 29th, and the weather was, on the whole, I fancy, clearer than is usual at this season. The tides also at the last full moon have receded much farther than I have ever seen during the last year Have you a file of Cape papers at hand? Not long since a similar occurrence was experienced in Table Bay and at the time, even such fish as were taken by hook produced disease amongst those who ate them. No such calamity, I am glad to say, has attended the

incident here. It appeared quite a windfall to the poorer classes, who gathered up such as had not become decomposed with great eagerness."

This state of matters extended, I am assured, at least forty miles out to sea, and while the native theory of the fall of a star is that which will least readily be admitted, I am at a loss what theory to adduce to account for the phenomenon.

I observe from my journal that the 23rd January, the date at which this extraordinary appearance was met with, was near the close of a periodic atmospheric perturbation of unusual violence. It prevailed all over India, and was felt from Ceylon to the Mediterranean Sea. I am very far from assuming that luminous appearances of the sea have anything to do with the condition of the air, but there are three of the cases that I have enumerated where they have occurred coincidently and all that can be said of the others is, that I have no record of what the state of the weather then was. It would be very unsafe, however, on this ground to assume the want of coincidence. Everyone is aware of the susceptibility of the birds of the air and the beasts of the field to atmospheric influences, and it is quite possible that the inhabitants of the deep may be as much so. What we want is more information on the subject, and I place in your hands my humble mite that I may not be blamed for at once complaining and failing to contribute.

The following are from the Journals of the Bengal Asiatic Society for 1854 and 1855 :—

"Captain Bowen of the P. and O. S. Str 'Bengal' has obliged me with the following note of a tract of white milky sea passed through by him on his recent voyage from Aden to Ceylon.

Monday, 16th January, 1854.

At 7 P M ship entered into a perfectly white milky sea, cloudy on the horizon but perfectly clear; bright star-light; moon half an hour from rising.

Stopped and tried for soundings 90 fathoms. No bottom.

Density of the water before entering that strange appearance 11°. Density of the water when sounding 14°.

Sympiesometer,	29°	90
Barometer,	30	12
Thermometer,	80	0
Latitude 11° 59 N. Longitude, E.	59	2

I may remark that previous to entering this strange sea, there was a moderate ripple on the water and after leaving it also, but smooth like oil when in it.

(Signed) JOHN BOWEN,
S. S. 'Bengal', from Aden to Ceylon,

In his letter Captain Bowen says: "I once saw the like on the Malabar coast fourteen or fifteen years ago, but not at all to the exteent this was; for the horizon (on this occasion) was in the same state as the water alongside."

I have once before recorded (Proceedings for March, 1847, Journal Vol. XVI p. 332), an instance in which this milky luminous appearance was seen off the Cape of Good Hope, and Dr. Buist in the Transactions of the Bombay Geographical Society has also recorded an instance in which a Company's Steamer from Bombay to Aden passed through a large extent of it; and it is I think mentioned also in Horsburgh and some modern books of voyages? but we are so ignorant to what it can be owing, that every accurate notice of it is worth registering. If we could obtain some bottles of the water, carefully put up and corked, we might perhaps, between chemical testing and the microscope, arrive at some results worth knowing; unless the appearance be purely electrical phenomenon?

Hong Kong, June 6th, 1855.

To the Secretary of the Asiatic Society.

"DEAR SIR,—A short time since, I had an opportunity of examining some Nos. of your Journal and find (Jour. No. II. 1854, p. 206) that you solicit further notices of such phenomena as Capt. Bowen has given you on the preceding page. Accordingly I send you the following copy of notes taken immediately after witnessing the phenomena they describe.

Ship 'Shooting Star' bound from N. Y. to Hong Kong, Thursday, July 27th, 1854. Lat. 11° 27 N; Long. 105° 40 E.

7½ P. M. A little cloudy on the horizon, but very clear bright starlight, fresh breeze. Air 73° F. Ship entered light-colored water, and in about 15 minutes the sea as far as the eye could reach appeared like an immense field of snow, no ripples, but smooth like oil, so that when the ship's bows threw up a ripple it immediately fell back to its former level. Orders were given to heave the lead, when 60 fathoms found no bottom. The light from the water illuminated objects on deck and dimmed all stars within 20° of the horizon. Looking over the widest part of it, the horizon appeared like a dim Aurora Borealis. Ship's head North, passed 10 miles through this patch, then a mile through ordinary colored seawater, and again through another patch of 10 miles of light water: limits of light water well defined.

Dipped up deck a tub full of this water, and found it 78½°, same as water in the morning. The tub presented a brilliant sight, being filled with bright self-luminous serpentine animalcule, varying from half an inch to five inches in length. Examined carefully in the hand, by the light, they were found to be nearly transparent, about the size of a hair in the middle, and tapering a little towards each end; of a jelly-like substance which burnt in the candle with a red light, and crisped like burnt white cotton. A few were differently formed. Two were found capable of propelling themselves through still water in a tumbler. One of these was in the form of a concentric ring half an inch in diameter, with teeth-like projections on the inner-edge, and seemed to propel itself by contracting the diameter of the ring: it was preserved alive about 36 hours.

This examination satisfied me that the light is emitted by animalculæ, but I am most anxious to know if scientific men can explain *why* it appears at *certain times* and within such *prescribed limits*.

Yours truly,

A. R. WRIGHT,

Surgeon, P. and O. Co.'s

S. S. "LADY MARY WOOD."

Note on the Luminous Water in the Sea between Bombay and Aden,—By H. B. E. Frere, Esq. C. S. (Transactions of Bombay Branch of Royal Asiatic Society, 1856.)

MEMO: On board P. & O. Company's Steamer 'Singapoor' between Aden and Bombay, 6th Feb., 1856.

About 8 P. M. on the 5th February we entered a patch of luminous water, and continued sailing through it with little intermission till daybreak on the 6th. There were a few lanes of clear water, some of them 6 or 8 miles wide, as we were going about 9½ knots the patch must have been at least 70 or 80 miles across. Close to the ship, as we looked down perpendicularly where the water was agitated by the paddles and wake, the appearance was that of a milky fluid clouding and gradually mixing with the clear water; at a little distance the milky hue seemed more diffused, and 20 or 30 yards off the water seemed of an uniformly milky tint, or as if the whole surface up to the horizon (which was very clearly defined against the dark sky) had been covered with snow. Night clear and stars bright, with a few fleecy clouds which had exactly the same pearl white tinge, as similar clouds have at night over a snow-covered landscape, wind light from the N. W. The milky appearance seemed to proceed from an infinite number of small luminous points, and was rather stronger where the ripple from the ship's bows broke, but there was less than ordinary of the appearance of single brilliant phosphoric lights usually seen at this time of the year in these seas when the water is agitated. A bucket of water drawn up contained, as far as our naked eyes could discover, no greater abundance of phosphoric animalculæ than tropical sea-water always contains. The luminous or milky appearance ceased as day dawned, and when the sun rose the sea had no other than its usual appearance, unless it were a reddish brown tinge which might have been due to the ruddy morning clouds, though I fancied it was more general than it would have been from such a cause.

I have seen something of the same kind twice before. Once about 80 miles from Bombay in December 1853, when the night was very calm, and the edge of the luminous patch was so clearly defined that the Captain of the Steamer (*Lombay*) said, had he not been sure of his reckoning he should have supposed it was a line of breakers. As we approached, the surface was sufficiently luminous to enable us to see further than we could have done with a bright moon half-full. and when the ripple from the vessel or a fish disturbed the glassy surface, there was a flash of phosphoric light, and you could then fish by the increased light of the line on which they moved at a depth of several feet.

The other occasion was during the monsoon at Morora, when a small patch appeared to be driven against the rocks, and for half the night made the heavy breakers brilliant to an unusual degree.

At nightfall on the 6th the same appearance was seen, but the water was less milky, or rather the phosphorescence was less uniform and diffused, and there was a much greater proportion of very brilliant light, both of the small star-like kind, of the masses as large as blubber-fish, of which there were great numbers about the vessel after dawn. The officers of the watch said, that with more or less intermission the luminous appearance of the water continued through the night.

About midnight on the 9th and 10th February we ran into a similer patch much smaller than the former ones, but remarkable for diffused brightness, and freedom from any particular spots larger or more brilliant than the others. The effect was exactly that of a sea of milk. Some clouds on the horizon were relieved against it so distinctly that every one on deck thought they were the

land, then some 50 or 60 miles distant, nor was it for some time that the Captain felt satisfied we had not even drifted in-shore by some unusual current."

The following is an account of a luminious appearance seen from on board the *Madras* on her trip to Aden, July 1853, betwixt the twelfth and thirteenth parallels, and fiftieth and sixty-fifth meridians :—

"The sea was running very high, and it was blowing a gale of wind when we went on deck at about midnight, and it appeared at first as if there was a dense fog, but after a few minutes it became apparent that the horizon could be seen all around distinctly though faintly, as in some stage effect. The sea was of the faintest green color, almost like milk, and though so heavy a sea was running, yet even when looking over the side it appeared as smooth as glass—one could not even see the white spray of the waves as they toppled and broke. This appearance lasted for two nights and part of a third from about 10 o'clock till day break. Captain Down mentioned having seen it twice before near Ceylon."

ART. IV.—*A Narrative of a Visit to the Ruins of Tahrie, the supposed site of the ancient City of Siraff, also an Account of the ancient Commerce of the Gulf of Persia &c.*—BY CAPTAIN G. B. KEMPTHORNE, I. N.

In the beginning of the year 1835, whilst in charge of the Residency Bunder Boat conveying despatches from Bassadore to Bushire, an opportunity occurred to me of visiting the Port of Tahrie on the Persian Coast; in consequence of encountering a heavy North Wester off the place, I was induced to run in for shelter where I anchored in 2½ fathoms, within a quarter of a mile of the shore, with the sea as smooth as a mill pond, although a short distance outside it was much agitated, thus clearly indicating the gale was still blowing as hard as ever, but where the boat was lying it was scarcely felt at all, as the high land completely protected her from the fury of the Storm. The town of Tahrie is situated immediately under a remarkable Hill called Jibel Serai, or Barn Hill in Lat. 27°. 39'. North, and Long : 52°. 1'. East, it lies at the bottom of a deep Bay formed by two lofty head lands one to the Eastward called Rashnabon and the other to the Westward called Rasb Berdistan ; the anchoring ground is good, being a stiff clay, and a vessel might come to here in 5½ or 7 fathoms, and find excellent shelter from the Nort Westers ; the whole of the Persian Coast is very mountainous but the range in this part comes close down to the Sea, the base being only 3 miles or so from shore. The aspect of the country is arid and sterile in the extreme ; the sides of the Hills are quite destitute of either shrubs or vegetation, whilst on the plains skirting the shore a few groves of date trees only, and a green spot here and there, like oases springing up amid the desert could be seen, not sufficient however to relieve the eye from the monotonous prospect. The Natives who are a mixture of Persian and Arab blood, are very poor, and they appear to cultivate the soil but little ; being chiefly fishermen, they have however a few flocks of sheep and goats, which the women and children tend and drive out in the mornings, to pick up what scanty herbage can be found in the ravines and on the Hill sides. The town is built on a rising ground on the East side of the Bay ; it is small, consisting of not more than 600 or 700 inhabitants ; the houses are flat roofed

one story high, chiefly built with mud or sand stone. The streets, if they can be so called, are exceedingly narrow and dirty ; it is defended on the Western side by an insignificant fortress or rather wall with loop holes for musketry, flanked at every 60 yards or so with round towers, leaving the other three sides of the town entirely unprotected ; the place is governed by a Persian Khan, who collects what little revenue he can from this impoverished place, which is sent to the Government of Shiraz, but as there is scarcely any trade carried on, except in salt-fish, tabacco &c., nor any taxable property, of course the revenue must necessarily be very small if not nominal. After a short visit to this miserable town, redolent with odours not of the most agreeable kind in the world, backed as they were by a more than ordinary proportion of squalling children, and yelping curs, I was as may be imagined, glad to get out of the place, and wander away alone in quest of the extensive ruins and sculptures with the Persepolitan character, which Morier describes as still to be seen at Tahrie, " besides two wells, pierced to a great depth, and a building sufficient for stabling a hundred horses; " after a quiet ramble of some two or three miles, I accidentally stumbled on the ruins, my attention having been first directed to some large pieces of prostrated pillars, together with broken capitals, blocks of hewn stone, and mounds which were scattered in endless confusion over the whole surface of the ground. In fact the surface for some two or three miles in extent, was one mass of shapeless heaps of rubbish, which however clearly indicated that here were the remains of a once opulent and populous city. It is now " a desolate wilderness, level down to the ground without " an inhabitant ; its foundations fallen, its walls utterly broken, and their temples levelled in the dust, the houses shattered in pieces like the wreck of a vessel on the Ocean, and now strewn over the Plain as fragments on the troubled waters ;" there is nothing now existing to denote the site, save huge mounds covered with prickly thistles, briars, and coarse grass, which completely hide the ruins from view, so that, it was difficult to discover them, and were it not for the broken shafts of pillars before reverted to, I should have been utterly ignorant. I was standing on a spot that had once been tenanted by industrious men, and what may have been the emporium of this part of the world, perhaps ages since, when the Persian Gulf was in fact the high road for the trade of India, and China, and Ships conveyed costly merchandize to the Banks of the Euphrates and Tigris, at the time the mighty, but now fallen Babylon, and the still more ancient yet majestic city of *buried Nineveh "(the earthly Queen)"* swayed the destinies of the world, and were in the full height of their splendour and magnificence, and whose merchants as we are told by the Prophet Nahum were "multiplied above the stars of heaven." But I am digressing from my subject, so will now return to it and inform the reader that after wandering about these most interesting ruins for some hours, without being able to discover any slabs or stones with inscription of any kind on them, whether of the arrow-headed or Persepolitan characters, as Morier says do exist here, and moreover having no implements or men to excavate the ground, I reluctantly left and proceeded towards a Hill nearly a mile off, rising about 200 feet abruptly from the plain, on the summit of which

I perceived, like the Acropolis of Athens, a building which seemed to be a fortress or temple, though in a dilapidated state. On reaching the base of this Hill, I could see no road or pathway leading to it, so had to scramble up an almost perpendicular cliff the best manner I could, over stones and crumbling soil, till at last I reached the top, which I found was a small plateau about a quarter of a mile broad, connected to the main chain of mountains, by a narrow strip of land, or Isthmus, a mile or so in length, and on the verge of a precipice overlooking the plain below facing the sea, stood the ruins of a large quadrangular Building of well cut stone, apparently of Mahomedan Architecture. The roof had fallen in; but the walls were in a good state of preservation, and the arches of the windows and door ways were pointed, not dissimilar to the Gothic style. The entrance was on the north side and this opened into an apartment about 80 feet long and some 60 wide, and from the appearance of the structure, I should say it had been used as a mosque or temple. On the left hand of the entrance and close to the side wall, was a flight of steps led into a large vault, or dungeon, about 100 feet long and 50 feet or so broad, excavated out of the solid rock, which I concluded might have been a reservoir for water or the stable Morier speaks of, as large enough to contain 100 horses, though I should hardly conceive it could ever have been used for the latter purpose, as the position on the summit of a Hill could never have been favorable for such a purpose. I regret I was unable to explore this cave thoroughly, in consequence of the darkness, besides, the loathsome and sickening smell that issued from it, owing to its being tenanted by myriads of bats. Near to this vault, was a well about 5 or 6 feet in diameter, sunk in the rock to a vast depth; a stone thrown down took some seconds in descending, and from this circumstance, I should conjecture it to be about 300 feet deep; it was however destitute of water, and the noise the heavy stones made as they struck the bottom, echoed like distant thunder, and I could even hear the sound rumbling gradually away in the distance, as if there was a subterranean passage leading perhaps out of the base of the Hill, for the purpose of conveying water to the inhabitants of the city; this no doubt is one of the wells Morier mentions. The ruined mosque stands amidst heaps of rubbish or debris of masonry, and this narrow plateau, must have been at one time used as a burial place; for large sepulchral stones were seen strewn about in all directions, in the greatest state of confusion, as if the graves of the dead had been ransacked and disturbed by some ruthless hands. These monumental slabs were of sand stone, all hollowed out; they were of an oblong form, about 4 feet long, 2 broad and 2½ feet in depth, many being in a sadly dilapidated state, broken to pieces in fact, but a few were however found almost perfect, having received little or no injury from time, or the hand of man, with the exception of a hole knocked out at one end, and curious to relate the whole of the stones found had the same defect, for what reason, it is imposible to conjecture unless it was done in the hopes of finding treasure secreted within; but why all these monuments, if they were really so, should have been hollowed must be left to the antiquary to determine, for it is quite beyond my comprehension, they were most beautifully, and very elaborately

carved, with flowers and other devices on the sides and ends, around the edges at the top and bottom within a sort of border, was a cufic inscription, as sharp and as well defined as if cut only yesterday, and as it is clearly known, that the Khoran was originally written in this character and continued in use, till the appearance of the Niskki in the 10th century of the Christian Era, and the kufic being now only found in the M.S. and inscriptions of the first ages of the Hegira, it might then be calculated these stones would be about 600 or 800 years old. Feeling anxious to secure a good specimen of one of these monumental slabs, and seeing one lying on its side near the edge of a precipice, where it could easily be rolled down, I at once procured the assistance of some Seedies belonging to the Buggalows lying in the Bay, and although it weighed about 200 or 300 lbs. we succeeded after a great deal of trouble in conveying it about 2 or 3 miles, and at last deposited my prize in perfect safety on board the Bunder Boat under my charge, and I afterwards in the year 1837 brought it to Bombay, and presented it to the museum of the Bombay Branch of the Royal Asiatic Society, where it will now be found at the entrance Hall close to the Office of the Military Auditor General, amongst a number of marble slabs bearing inscriptions I believe in some ancient Hindoo character : But to proceed with my narrative, on the same platean where the ruins of the mosque stood, the dungeon, the deep well, and tomb stones were found, I perceived whilst wandering over the spot, a great number of circular shafts, running from each other North and South, at about 50 yards equi-distant in the direction of the chain of mountains, curiosity induced me to descend one of them, which I managed to effect by pressing my hands and feet against the sides of the shaft, and thus lowering myself gradually down. I found it was about 4 feet in diamater and 30 deep, and at the bottom was a narrow subterranean passage nicely cut and levelled, which led from one shaft to the other. It was only of sufficient height and width to enable me to crawl along in a stooping posture, which I managed however to do, and on reaching the next opening, I ascended in the same way as I went down. The inspection I had made, short as it was, was quite sufficient to convince me that this subterranean passage was intended as an aqueduct, the one most probably Morier alludes to, and which no doubt conveyed water to the inhabitants of the city, by means of the reservoir or the well. The shafts I imagine were for the purpose of giving light and ventilation, within the aqueduct, so that the water might not become impure by want of a due proportion of atmospheric air, but I think it would not be out of place were I to quote some remarks (as regards these kinds of aqueducts) made by Morier in his second journey to Persia pages " 163 and 164 " which perhaps may not be uninteresting, as they might throw some light on the object of their construction. " This subject he says acquires considerable importance from the manner in which it is noticed by Polybius. His observations coincide so closely with the present mode of obtaining water by means of kanauts, that no doubt can remain, that it is one which has maintained itself in the country from the time of ancient Persia. The extreme dryness of the climate and the great deficiency of rivers, have obliged the natives to turn all their ingenuity to the discovery of springs, and to the bringing of their streams to the surface of the earth. To effect this

when a spring has been discovered, they dig a well until they meet with the water, and if they find that its quantity is sufficient to repay them for proceeding with the work, they dig a second well, so distant from the other as to allow a subterranean communication between both. They then ascertain the nearest line of communication with the level of the plain, upon which the water is to be brought into use, and dig a succession of wells, with subterranean communications between the whole suite of them, until the water at length comes to the surface, when it is conducted by banked up channels into the field or wherever may be its destination. The extent of the country through which streams are sometimes conducted is quite extraordinary, mouths of wells are to be frequently met with in lonely vallies, and may be traced in different windings into the plain. It is because the water flows through these, invisible of course to the eye, that the Historian, said no water is ever seen above the surface of the ground, and the immunities which he mentions the Persians bestowed upon those who brought water to places in which there was none before, evidently shews that they were held in the same degree of consequence as at the present day."—These observations of Morrier so perfectly coincide with the description of aqueduct I discovered at Tahrie, that I have no doubt whatever as to the nature for which it was intended, and that the water must have been conducted along this channel, from some neighbouring mountain spring or stream.*—On the opposite side of the Hill to the Westward about 2 miles off, I could distinctly see numerous excavations, hewn out of the face of an almost perpendicular and inaccessible cliff, about 200 or 300 feet above the plain, being anxious to know for what object these caverns could have been made for. I tried to reach them, but as there were no steps cut in the rock, I found it perfectly impossible to scale such a height, and I was obliged reluctantly to quit, without being able to gratify my wishes; from what I could observe however, I should imagine the entrances or doorways of these singular excavations were about 7 or 8 feet high by 5 or 6 wide nearly square, but as they were situated so great a distance up the face of the Hill, it was difficult to form a correct idea of their size, and I am unable to say, whether they were intended as abodes for the living or sepulchres for the dead, but time and further research, will perhaps solve the question. I am inclined to think these grottoes may have been used for both purposes; as Seetzeen in his travels relates, "that towards the opposite extremity of the land of Moab and at a little distance from its borders, there are many families living in caverns; and he actually designates them the inhabitants of the rock, and at the distance of a few miles from the ruined site of Heshbon, there are many artificial caves in a large range of perpendicular cliffs, in some of which are chambers and small sleeping apartments. Captains Irby and Mangles speaking of the wonderful ruins of Petra, inform us that "the sides of the mountains, covered with an endless variety of excavated tombs and private dwellings, presented altogether the most singular scene ever beheld;" Lord Lindsay too says "he left the valley (Petra) after revisiting the kasne and exploring several excavated dwellings, for it is clear he thinks both from the

* Lieutenant Conyngham when exploring the ruined town on the Island of Geese, called Hamrah, describes a built and arched aqueduct [illegible] reservoir of the same kind

language of scripture and the appearance of the caves themselves that the majority, if not all of them, were the abodes of the living, not of the dead, and in proof of this he quotes a verse from the Prophet Jeremiah, 'O thou that dwellest in the clefts of the rocks, that holdest the height of the Hill, though thou shouldst make thy nest as high as the eagles, I will bring thee down from thence, saith the Lord ;' " Kennier and Morrier also in their travels in Persia frequently mention the existence of caves hewn out of the solid rock, and the former states that he saw several, on the western brow of a Hill at a place in the North of Persia called Margara, and that the natives know nothing of their history, they say that they are so old that no tradition has ever reached them, either with respect to the time when, or purposes for which, they were excavated ; there are no sculptures,nor will the caves either in magnitude or beauty bear the slightest comparison with those of India. He further says that Captain Grant in his travels on the Mekran Coast, saw in a valley on the north side of Tiz, the ancient Tiza of Ptolomey, in the Bay of Churbar Lat. 25°. 16' north, and Long. 60. 40 East, some caves, which had been excavated on the side of a Hill, about 100 feet or so above the base ; they were about 12 feet in diameter, and seemed to have been a Hindoo place of worship, as in one of them, was an altar on which a lamp had been burning, with marks of an animal having been killed in it ; "I am therefore of opinion that from these facts, the numerous grottoes I saw at Tahrie excavated out of the face of an almost perpendicular cliff, were most probably used, as in Moab, not only as dwelling places for the living, but also as places of sepulture, although I made what enquiries I could from the Natives about these caves, and the ruins, yet I could get no light whatever thrown on the subject, for the present inhabitants seemed to be utterly ignorant of anything regarding them ; they had no traditions of the existence of such a city, nor did they know why the caves on the sides of the mountain were excavated. They shewed such apathy in fact, about the whole matter, that I left them in disgust mingled with pity, for I could not help thinking how deficient in energy, must this race of men be, from those once inhabiting the spot, who had erected stately palaces, mansions, temples and whose streets must have thronged with thousands, whilst their commerce no doubt made it a flourishing, as well as one of the richest ports of the world. But now all is laid waste, the hum of man is barely heard, even over the rippling surge, and naught now exists to mark the site, but shapeless mounds and fragments of Pillars. I remained till past sunset wandering over this scene of melancholy desolation, and it was only when darkness began to close in, that I reluctantly quitted the place, but with the hopes it might be my fate to visit it again, for time would not then permit me to investigate more minutely those interesting ruins, which seem so little known to the world. I feel confident from what I then saw, that innumerable antiquities and sculptures might be discovered, which would throw some light on the history of a once great city, now enveloped in mystery. My opinion is that these ruins must be the true site of the ancient Siraff, (a port of consequence and the centre of an Oriental commerce in the 9th century of the Christian Era) and in this I differ widely

from Kinnier, Buckingham, Morier, and others, who say it is situated lower down the Gulf at the foot of a lofty Hill called Charack, (the Mount Ochus of the ancients,) near the small town of Cheroo opposite the Island of Gese corrupted to Khen but as no ruins of any kind or of any importance have ever been found there, by those who have visited the place, still further confirms my belief that the present Tahrie, and not Cheroo, is the identical site of Siraff, and it is also my firm conviction, that this Port was at one time the grand emporium of this part of the world, long ere the Island of Ormuz, and the town of Gombaroon became the great marts of trade, for in the port of Siraff, vessels anchored laden with the richest products of India, Ceylon, China, the Eastern Seas, Southern Arabia, bringing too, the Myrrh, Gum, Frankincense, Ivory, and Gold dust, from Africa, and this extensive traffic was chiefly conducted by the Arabians; "who we are told were for ages the great carriers of Europe, and did more than either the Greeks or Romans with respect to the commerce of the East; and in such a manner that they kept out all others from navigating those Seas, and thereby drew an immense profit to themselves, for the Indians brought by land to Cabul and some other places, and the Arabs by sea to Siraff and Bassorah, all the commodities of India, and China;" Siraff was conquered in the year 1320 by the Shah Kolhaden and the trade was afterwards transferred to the Island of Gese or Khenn, from which date may be considered the rapid decline and ultimate downfall of this ancient city; it never afterwards recovered either its commerce or its opulence, and it must have been gradually deserted by its inhabitants, as being no longer "the resort for foreign Merchants." Siraff is spoken of as a great place of trade in A. D. 915 by Abu Sied l Hussain, an Arabian; Eba Wahab also says that he dwelt at Bussorah and when that city was sacked by Aboo Sied A. D. 893 he fled from that town, and came to Siraff, where he saw a ship ready to sail for China, when the humour took him to go on board this vessel, and in her he went to China. This merchant accurately describes the Red Sea, and he states that the ships of Siraff when they arrive in this Sea, put into Juddah where they remain, and their cargoes are then transported to Cairo or Kehira, by ships of Kolzun who are acquainted, with the Navigation of the Red Sea, which those of Siraff dare not attempt, because of the extreme danger, and because this sea is full of rocks at the water's edge, because also upon the whole coast, there are no kings, or scarce any inhabited place, and in fine because ships are every night obliged to put into some port of safety; for fear of striking upon the rocks, they sail in the day time only, and all night ride fast at anchor. Morier also relates a curious story similar to Whittington and his cat, which may not be uninteresting if I here quote it.* An old woman who lived in the town of Siraff with her three sons, who turning profligate, spent their own patrimony and their mother's fortune, abandoned her, and went to live at Gese or Khenn. A little while after a Siraff merchant undertook a trading voyage to India, and freighted a ship. It was customary in those days, that when a person undertook

* I merely quote the curious story of Morier as [illegible] the important trade that was carried on with Siraff and India in remote ages."

a voyage to a distant land, each of his friends entrusted to his care some article of their property, and received its produce in return. The old woman who was a friend of the merchant, complained that her sons had left her so destitute, that except a cat, she had nothing to send as an adventure, which she requested him to take; the merchant did so, and on his arrival in India, he waited on the king of the country, who invited him to dine, and granted him permission to trade with his subjects; he was surprised to see that the king and courtiers had their beards encased in golden tubes, and that every man had a stick in his hand, but his astonishment still increased, when upon serving up of the dishes, he saw swarms of mice make such an attack upon the victuals, that the guests had great difficulty in keeping them off with their sticks. The scene brought the cat of the old woman of Siraff to his mind, and when next he dined with the king, he put the cat under his arm, and no sooner did the mice appear than he let it go and to the delight of the king and his attendants hundreds of mice were laid dead on the floor. The king long to possess so valuable an animal, and in return sent the merchant a finely equipped ship, laden with all sorts of merchandize, which was to be given to the old woman for her cat, and this was done on the arrival of this vessel at Siraff. She imparted her good fortune to her sons, who came over to her and then embarked with their mother and property and established themselves at Gese or Khen. Here they traded with great success, and their names grew so famous that twelve ships were consigned to them; they at last became so powerful that they braved the king of the country and in course of time their descendants raised themselves to be kings of Gése, and who were known in Persian History under the name of the Beni Gúser. Their power however was at last destroyed by Atta Beg the King of Fars; since then their possessions have been annexed to the Persian Dominions." It is related that the Government of Aba Bukker A. D. 1270, was distinguished by the reduction of the Island of Gese or Khen, also the towns of Katief, and Bahrein, in the Gulf of Persia, whereby he is stated to have acquired prodigious wealth."

As regards the trade carried on by way of the Gulf of Persia, even from the earliest times, we are told by Dr. Vincent that "Petra the capital of Edam, the Idumea or Arabia Petra, of the Greeks the Nabatia, was considered both by geographers, historians and poets, as the source of all the precious commodities of the East. The caravans of all ages from Minea, in the interior of Arabia, and from Gheria (or Katief) in the Gulf of Persia, from Hydramaut on the Ocean, and some even from Sabea or Yemen, appear to have pointed to Petra as a common centre, and from Petra, the trade seems again to have branched out in every direction to Egypt, to Palestine, and Syria through Arsinoe (Suez) Gaza, Tyre, Jerusalem, Damascus, and a variety of subordinate routes, that all terminated in the Mediterranean. There is every proof requisite, to shew that the Tyrians and Tidonians were the first merchants who introduced the produce of India to all the nations, which encircled the Mediterranean, so there is the strongest evidence to prove, that the Tyrians obtained all their commodities from Arabia which was the centre of this commerce Petra was the point to which all the Arabians tended, from the three

sides of their vast Peninsula, in fact as Dr. Crichton in his admirable work on Arabia and its people says. "The fleets of Solomon and Hiram frequented its Seas, and traded in its markets, importing thence the gold, and the ivory, of which we read of in the Chronicles of the times. Its traffic and its merchandize are renowned both in sacred and profane history, and for many ages it continued to be the only connecting link of commercial intercourse between the nations of the East and the West. The inspired writers have borrowed from its manners and its productions, some of their finest allusions, and most striking descriptions. They make frequent references to the tabernacles of Edom, the flocks of Kedar and Nebaioth, the incense of Sheba, and the treasures of Ophir," and again in page 126 the same author states: "The principal occupation to which they owed their wealth, and their fame, was commerce; that the Arabs were the first navigators of their own Seas, and the first carriers of the Oriental produce is evident from all History, and that they had been so from the remotest ages we may safely infer from analogy, from necessity, and from local situation; Sabea, Hydramaut, and Oman, were the residence of merchants, from the very dawn of civilization; they had frequented the ports of the Red Sea, crossed the Persian Gulf, and with the aid of the monsoon visited the coasts of India, long before these regions were known to the nations of Europe. Moses speaks of cinnamon, cassia, myrrh, and other aromatics, appropriated to religious uses, (Exodus xxx. 22 25) and he mentions them in such quantities, as plainly shows they were neither of rare, nor difficult attainment and that even in his time the communication was opened between India and Arabia." Augustus had formed a design of conquering the Peninsula of Arabia, as the inhabitants of the Coast between the Arabian and Persian Gulf were in possession of the whole trade of the East. Trajan too made the attempt from the Persian side with no other view, than to have made himself the possessor of the wealth which the Arabians had amassed, by their extensive commerce, but he also failed. Alexander the Great designed the construction of a large fleet in the Indian Ocean, for which purpose he caused 47 large ships to be built by the Phœnicians, then taken to pieces and brought to Thapsacus, on the Euphrates, and thence to Babylon; the use he intended to make of these ships was to examine the Indian Coast, to take an account of the places, where convenient Forts might be made, as also to acquire perfect knowledge as to the nature and qualities of the Indian commodities; he also intended by the aid of this fleet, to conquer Arabia, for he was desirous of being master of the riches, for at that time the Arabians had abundance of gold and silver, and possessed all the spices and rich perfumes, which were known to the world; he thought proper to send three of his ablest officers; each in a large ship, to examine the Coast. Archias proceeded out of the mouth of the Euphrates, and discovered at the distance of 120 Stadia, an Island in which was a temple sacred to Diana, which was named by command of Alexander, Icarus; He also discovered another and a larger Island at distance of a day and a night's sail from the river's mouth, the name of which was Tylos (Bahrein); it was not overgrown with wood, but a well inhabited, well cultivated country; further he durst not proceed, but Andros

thenes, who had a ship of the same burden, sailed further and examined the maritime Coast of Arabia. Hieren however excelled them both, for he sailed quite round the Chersonese into the Arabian Gulf (Red Sea) and so to the opposite Coast of Egypt. The source of the great wealth of Palmyra, was the share it had in the commerce of the Indies, the goods were carried by sea through the Persian Gulf to the mouth of the Euphrates, or perhaps little higher up, and thence they were sent by land in caravans, for some 100 miles through the desert, to Palmyra, which stood one day's journey from the Euphrates, 127 miles from Damascus, and at 203 from the Coast of Syria, by the ports of which, the goods were dispersed to all the different parts of the Roman Empire, that did not immediately correspond with the harbour of Alexandria; from the time of Adrian to that of Aurelian the space of 140 years, the city increased and flourished. Aurelian, in a fit of revenge made himself master of the place, and caused the inhabitants of the city to be destroyed without mercy; this dreadful destruction of Palmyra happened A. D. 272. " Dr Crichton also informs us that of " the different countries that traded with Arabia, of the rates of exchange, relative amount of exports and imports, we are left without any precise information; that the balance of trade must have been in favor of the Arabs, we may infer from the rich dresses, and gorgeous luxuries, which attracted the wonder and cupidity of all strangers; from their geographical position they became the centre of all traffic, between India, Africa, and Europe; on the western shores of the Red Sea, the chief marts were Arsinoe, Myos, Hormos, Berenice, Ptolemais, Theron, and Adulis Adel. It was in the two latter ports, that the Hunters of Ptolemy procured elephants for his army; on the Arabian Coast the harbours most frequented, were Alana or Ezion-gaber, Leuke-kome, where the Romans in the time of Augustus had a garrison, Moosa (Mocha) more than a thousand miles down the Coast, and Ocelies on the Strait of Dira, (Babelmandeb). The latter market in the time of Pliny, was the most celebrated for the merchandize of India, while Moosa was the great entrepôt for the native productions of Arabia; Aden was the ancient centre of traffic between India and the Red Sea. The ships of the East being too large to pass the Straits (Babelmandeb) landed their cargoes here. It was destroyed by the Emperor Claudius with the view of suppressing every power that might interfere with the Roman commerce, and of increasing his revenues from the duties, on the trade of the Gulf which were collected by Plocamus with the garrison stationed at Leuke-kome. In the time of Constantine about A. D. 320 Aden had recovered its commercial celebrity; and being subject to the Empire it got the name of Romanium Emporium; Gése, Sahar (Sohar) the Sachalitis of the Greeks, and Moscha (Muscat) were noted for various native exports, especially incense, and aloes, Gherra, (Katief) was the most celebrated mart on the Persian Gulf. The Gherrians crossed the desert to Petra, Bosra, and Damascus, and were among the earliest conductors of caravans on the road. We learn from Strabo that they furnished a variety of articles in spices, and aromatics to the Syrians and Phœnicians, who commanded the traffic of Egypt, and the Mediterranean. Thebes and Memphis also traded with the Arabs, and were celebrated as

mercantile cities, more than a thousand years before the foundation of Alaxendria or Cairo. In the hands of Solomon the traffic of the Red Sea produced a revenue equivalent to three millions and a half (1st Kings x. 14) and at the period when the Romans invaded the East, this lucrative monopoly was exercised by the Sabœns ; whose marts they found richly stored with all the precious commodities of India, and writers both sacred and profane, speak of the valuable and extensive trade of Saba or Yemen. Diodorus considered the happy Arabians so immensely opulent that all the treasures of the world seemed to centre there, as in one universal mart. Agatharcides the first historian worthy of credit, who describes the commerce of Yemen, and its different productions as it stood two hundred years B. C., says at that time, Arabia was the medium of communication between India and Egypt, and it was in her ports, that the Greeks went to purchase their cargoes, before they had ventured to make the distant voyages themselves. Saba he observes abounded with every production that could make life happy. The land yielded not merely the usual commodities ; but balm, cassia, incense, myrrh, and cinnamon were of common growth. The trees wept odorous gums, and the gales were so perfumed with excessive fragrance that the natives were obliged to renew their cloyed senses of pleasure by burning pitch and goat's hair under their noses ; they cooked their victuals with scented woods, living in the careless and delightful enjoyment of those blessings, which conferred on their country the appellation of " Happy ;" in their expensive habits they rivalled the magnificence of princes, their houses were decorated with pillars, glistening with gold and silver, their doors were of ivory crowned with vases, and studded with jewels. The interior of their habitations corresponded with their outward appearance ; in articles of plate, sculpture, in furniture, beds, tripods, and various household embellishments ; they far surpassed any thing that Europeans ever beheld ; other writers Arian, Strabo &c speak in similar terms of the luxury and riches of the Sabœns ; such however is the brilliant picture which the enraptured imagination of foreigners drew of the Happy Arabia ; but truth compels us to avow that the discoveries of modern travellers have drawn aside the veil of romance from this fairy land. They do not find it that paradise of ambroisal felicity, and inexpressible delights, which antiquity represented it. Its real or ideal treasures have vanished, and no Alexander in our times, would dream of making its balmy vales the seat of a mighty empire. The incense, so famous in antiquity, as said to grow in Arabia, we can find no satisfactory account of in ancient authors as regards the production and collection of this celebrated commodity, which was wrapt in such fable and mystery, naturalists were not even certain as to the kind of shrub that produced it, but it is supposed to be a species of amyris or balm tree, so rich in affording gum resins. Theophrastus in his history of plants, says it grew wild in Arabia, on the slopes of the mountains ; and the native writers assert that the districts where it was most common were those of Merbat, Sahar, and Mahrah, and the Greek geographers mention that the native country of incense is Hydramaut.

The mountains of Southern Arabia about Ras-morbat produce incense in great abundance, and I believe the only European who has visited the inland

Coast and has published a description of the tree is Dr. Carter. I have also made a tour (though a hasty one it is true) to the Frankincense Country of Adel on the Coast of Africa, and it was, I fear, barely sufficient to enable me to give either a correct or precise account of the country, where these Thuriferous forests abounded. I however faintly endeavoured to describe the tree that produces this most valuable gum, and certainly it was one of the most extraordinary plants, I ever saw, quite a *lusus naturæ* of the vegetable world, for the trees actually grew out of the sides of the almost polished marble rocks, without in any way (as far as I could observe) receiving nourishment from the soil, but soil there was none, for this range of lofty mountains, is nearly denuded of that. The trees were about 40 feet high, the stem was about two feet in circumference, rising straight up, with a bend outwards of six or seven inches, they are attached most firmly to the rocks by a thick oval mass of substance, about a foot or so in diameter, something resembling a mixture of lime and mortar, branches spring out rather scantily at the top, and extend a few feet down the stem, the leaves are five inches or so long, and one and a half broad, narrowing and rounding towards the point, but not serriated at the edges ; the upper surface is of a rich dark shining green, while the lower is of a lighter hue ; they are thin and smooth, and crimped like that beautiful species of sea weed so often found on the Coast of England ; the tree has four layers of barks, the outer being coarse and loose, like that of the beech, while the next two are as it were glued to the trunk and delicately fine, resembling oiled paper, or gold beaters skin, and of a bright amber colour ; this bark is perfectly transparent and can be stripped off very easily in large sheets ; the natives use it for writing on ; the inner bark of all, is an inch or so in thickness, adhering closely to the stem ; it is tough not unlike leather, and striped red and white, and yields a strong aromatic perfume. The timber is white, soft and porous and of little use, except as firewood a deep incision into the bark causes the odoriferous gum to exude in large quantities, which is of a milky white and of a consistency of honey, but it soon hardens by exposure to the atmosphere. It is a remarkable fact that not a single frankincense tree did I perceive growing upon any other rocks than those of almost pure limestone and it clung so tenaciously to them, that no force of ours could even detach one. I regretted not being a naturalist sufficient to have described botanically this curious plant for it is one well worthy of attention, but my account imperfect and unsatisfactory as it is, may in a measure serve to throw some light on a tree so little known to the ancients, or even to the moderns, and which still remains wrapped in nearly as much mystery as in the days of Solomon. The nature of the plant in my opinion is of such a peculiar character that if it could be transplanted to the earth it would perish perhaps for the lack of that particular nourishment, which may be obtained in some unaccountable way from these marble cliffs, for the whole range, where these Thuriferous forests abound, is of pure limestone, and might it not therefore be possible that the tree receives its support from the carbonate of lime, through some decomposition of the stone ; this however is a mere conjecture, so I must fain leave it to the botanist, and chemist, to solve this curious problem.

It is my opinion that the trees on the Adel Coast are different from the species as described so ably by Dr. Carter, as my account and his, are somewhat at variance; however this may be entirely owing to a want of descriptive powers as a naturalist on my part. I further think that the locality from whence the ancients obtained their principal supply of frankincense, was situated on the almost inacessible mountains of Adel in Africa, facing the Southern Coast of Arabia, for the trees as we saw them, extended over such a vast tract of land, that large quantities, of the gums even now, must be collected annually, as in the times of the Greeks and Romans. Arabia I dare say also yielded the gum in abundance, but Adel must have been the chief producing country of this precious commodity. The plant grows at the height of between 2 000 or 3000 feet above the sea; it is never seen below that level and seldom above it, as shown by Commander Cruttenden, who has likewise visited the Frankincense country and has described it most fully, and most accurately. Dr. Vaughan and myself with one or two others were however the very first Europeans who made an excursion to the Thuriferous forests of Adel, and this was in 1843, and Commander Cruttenden was the next to follow a short time after, but he travelled in this interesting region, several weeks and had of course more ample means and opportunities of depicting the country of Adel than we had, for we only made a tour of a couple of days, and consequently had not time sufficient to note down such remarks as could have been desired. These observations are merely offered for the purpose of clearing up, not only the mystery attached to the region, from whence the frankincense has been supplied, but also to make known if possible the species of plants producing a gum of so valuable and of so important a nature, for in the days of the Pharoahs, even kings and merchant princes, traded to Arabia for it, and derived large revenues and vast profits from this commodity alone.

I have endeavoured in this memoir to shew that the commerce carried on through the Persian Gulf, must have been coeval with the earliest dawn of civilization, and my firm conviction is that many cities must have existed in those days along its shores, which are now a heap of ruins, though we know but little of them, no more than we do of Tahrie which in my opinion is the true site of the ancient Siraff, a port beyond a doubt of great commercial consequence, at least as early as the ninth century; but when, and at what period the city was founded, history is altogether silent, and this point can only be solved by the result of future discoveries, which I am certain will be made sooner or later, for slabs with inscriptions in the cuneiform character, do exist among the ruins of Tahrie there can be no question, though at present none have been found; should however such be the case and if the inscription could be deciphered, some information might be thrown on the mode the ancients adopted in conveying the traffic of the East, to the banks of the Euphrates and Tigris, of which we know little now; it is also astonishing that we should have remained almost in utter ignorance of the existence of ruins such as at Tahrie, Katief (the ancient Gherra) the once far famed entrepot, for spices and perfumes of the South, for Pliny says "the city was five miles in circumference, the walls

and towers of which, were said to be built of fossil salt." Agatharcides compares their riches with those of the Sabœns, and adds, that they brought much wealth into Syria, "the ruins too on the Island of Gese, those also said to exist inland of the modern town of Lingar on the Persian Coast, which were visited in 1694 by Genelli Careri; a once populous city called Kalhat situated on the top of a mountain, between Muscat and Ras-el-Had, was described by the Portuguese in 1507, as a beautiful place built after the manner usual in Spain; they however plundered and burned it a year afterwards; its name and site is now unknown, the ancient trade of Tohar has departed, though it is still the principal town on the Batnah Coast, just above Muscat, and Edrese who wrote in the year 1153, informs us that Sohar is the ancientest city of Oman, sometime the port for the China ships, which now is ceased, because of the Island of Gese or Kenn.* Sohar is at present little more than a fishing village. I visited it in 1828 whilst on survey, and saw no remains of its former splendour. Lieut. Constable I. N that talented young officer who has taken so much interest in the Hydrographhy, as well as in everything connected with the Persian Gulf, says in his interesting memoir (from which I have borrowed a few extracts) that he was informed by the inhabitants of Kasab near Elphinstone's Inlet, "that there *were stones* up a valley among the "mountains about 15 miles from the shore, which were covered with written "characters engraved in the rocks; he also states that there "are the remains "of a Fort on Ras moosendom, an Island about two miles long; those "remains consist of blocks of stone, squared, with too much care to have "been of modern origin, and therefore might be the remains of a building "which anciently served as a watch tower;" about four miles from Bushire "this officer also states, are the mounds of Rusher encircled by a wide "and deep ditch, and the Persian Geographer Handaallah Cazvini who wrote "in the 14th century dates its foundation above 500 years B. C.; at Risher "earthen-ware urns have been dug up of the same description as those found "on the banks of the Tigris." Tiez situated on the Mekran Coast, the ancient Tiza of Ptolomy was once an opulent commercial city even as far back as the year 70 of the Christian Era, but it is now only a heap of ruins and a place barely named; whilst I was employed however on a hasty survey of this Coast in 1829 several officers of the H. C. Surveying Ship Benares visited Tiez, but they were unable to give any clear or satisfactory account of the remains, as there was not one stone left standing on another; all they saw were confused heaps of bricks and masonry, overgrown with grass and weeds; a brief notice of this visit was published by me in the 5th vol: of the Transactions of the Royal Geographical Society. The town of Tiez, I believe did exist when the Portuguese first visited India, or about the time they held possession of the far famed city of Ormuz; but I am unable positively to state whether this was so or not, having no book on this subject to refer to, Kennier in his travels in Persia merely alludes to it, but nothing more From the facts above mentioned I feel convinced as also does Lieutenant Constable, that if a thorough investigation

* Gese or Kenn had monopolized the trade of Sohar at that period.

was made along the shores of the Persian Gulf, much important and much interesting information might be gleaned, that would well and amply repay the traveller, and the antiquary for the trouble of such an examination ; as there is a mass of knowledge, not only yet to be gained, as regards the commerce of the Gulf in ages gone by, but a great light would also be thrown on many ruins of cities, which are now altogether veiled in darkness and mystery. In conclusion I would here remark that although a memoir was written by me on the ruins of Tahrie in 1838 and which appeared in the Transactions of the Bombay Geographical Society vol : 1 page 294, yet as a new interest has been thrown on the place by some recent discoveries made by two officers Dr. Lumsdaine and Mr. L. Osborne of the H. C. Corvette Falkland who visited the spot a few months since, has determined me to re-write the original article from rough notes still in my possession, and I trust the present narrative may even now at this distance of time, not be considered out of place, or beyond the pale, of what may afford some slight information, regarding a part of the world, not much known to the European Savans, though I fear the memoir will be found rather prolix and perhaps unskilfully written ; however if it be the means of causing some adventurous traveller to inspect the ruins of Tahrie as well as other places, I shall be amply repaid, and I hope the two gentlemen I have named will ere long publish their own account of what they saw at Tahrie, which I believe perfectly concides with my observations. Some of the caves I have alluded to in a former part of this narative, were inspected by them ; they found these grottoes hewn out of the face of almost inaccessible cliffs, and human bones and skulls were scattered over the floor on the inside, evidently shewing these excavations were used as places of sepulture ; no carved work, or sculpture, however could be discovered, in any of them, nor were any inscriptions seen even among the ruins ; the deep wells were also visited by Dr. Lumsdaine and Mr. Osborne, and the ruins on the summit of the Hill, were likewise noticed by them.

Regarding the remarks I have herein made about the ruins of Tahrie, as well as other cities, and more especially as to the ancient trade of the Gulf, I am indebted for much interesting information, from the writings of Morier, Kennier, Gibbon, Crichton, Keith, Irby and Mangles &c ; and I cannot refrain from saying that these Extracts are made, for the simple reason, that by rembodying the observations of these learned authors in a small pamphlet, it would perhaps be easier to throw more interest on the ruins, and ancient traffic of the Gulf, than by any other means.

G B Kempthorne,
Captain. I N.

Bombay
9th October 1856.

After concluding the above narrative, the following information was kindly furnished me by Lieutenant Constable, which may be interesting as

proving that ruins do exist at Towenah and Gese or Kenn, of which we know little of.

"Between Towenah and Charack, is a little Quoin hill conspicuous from Gese ; it is called Jebelel-el-Lumba; on it are ruins as usual said to have been "a European Establishment.—An Arab of Gese also told me the origin of the "power and wealth which that Island enjoyed in the 10th and 11th centuries "as he had it from his father. A man named Ahmad who lived on Jebel Lumb "while crossing the bed of the wady at Charrack, a torrent came down which "carried him out to sea, and he landed on Gese, then uninhabited ; here he "found so many pearls,that soon he amassed great wealth,he quickly obtained "followers,and afterwards laid the foundation of a town,and became the Sultan "Ahmad.

"An example of the knowledge the present Arabs have, of the history of "Gese, showing how historical facts become distorted in their descent from "generation to generation !!"

ART. V.—*Notice of Borneo, the Eastern Archipelago—a Lecture delivered before the Bombay Geographical Society, Sept.* 20,1855.—By COLONEL LEGRAND JACOB, *Resident, Cutch.*

COLONEL JACOB said that the remarks he had to make were not strictly Geographical, but he believed that the Society did not confine itself, very rigidly, to what was usually understood by the term Geography, but allowed considerable latitude in its discussion. He had not prepared any special paper, and should not have thought of obtruding himself upon them, but for the pressing solicitations of the Secretary. If they would bear with the desultory observations he might make on the vast sweep of most interesting countries he had lately visited, he would endeavour to cull a few passages from his memory such as might probably interest them. [Colonel Jacob here exhibited a large rug or carpet made of the skins of the Opposum,—a beautifully stuffed specimen af the male Ornithorincus Paradoxus, a creature with a bill like a duck, a furry skin like a beaver, spurs like a cock, and clawed feet like a rat—these animals are now becoming so scarce, that he failed to obtain the female,—the Walking Leaf, *i. e* the Phyllium Siccifolium, with eggs and young, given by the Government Botanist of Java, who regretted having only one specimen—of the still more extrordinary walking flower, a creature with a white body, pink spots, and crimson border—some other objects of interest were also shown, but our limits compel us to omit his explanations.] The vast group of Islands, betwixt Malacca and Australia, were comparatively little known to us ; when we gave back Java and its dependencies to the Dutch in 1815, our Government ceased to interest itself in that quarter of the world. Disputes arising, a treaty very favorable to Dutch interests was concluded in 1824, on the strength of which they claimed to shut us out altogether from the Archipelago, but this construction had been repudiated by the British Government. Anywise our trade was a good deal

hampered by duties and restrictions, the Americans being untrammelled by treaties, and left to the free exercise of their own unbounded energies, were more and more pushing commerce in that quarter, and it appeared likely that questions might ensue bringing on collisions with the Dutch, for brother Jonathan seemed disinclined to admit claims not supported by *de facto* rule. Colonel Jacob was surprised to find the whole direct pepper trade of Northern Sumatra in American hands, to the extent of nearly 100,000 peculs, filling about fifteen large ships. A part of Borneo had of late become celebrated from the actions of, and crimes imputed to, Sir James Brooke, Rajah of Sarawak. Being in the neighbourhood he was anxious to visit a locality, if not a person, so celebrated and learn something for himself of a man represented by one party as a robber, murderer and plunderer, every thing that was vile and abominable,—by another magnified as one of the great benefactors of our race. Though curious to see such a man, continued Colonel Jacob, I was not quite clear about visiting an assassin, and was anxious therefore to ascertain beforehand, what sort of man I was really likely to meet with. With this view I waded through all the Blue Books, pamphlets, and articles that had been published on the subject, and the conclusion I arrived at was, that the charges against him were without an atom of foundation. They were rumours set on foot by an unscrupulous party whose views in getting up another great South Sea Bubble Brooke had thwarted; swelled into importance by the persevering obstinacy, to use a no more stringest term of Joseph Hume, and the outcry of a portion of Exeter Hall; all misled by the misrepresentations of the aforesaid party, and of an active mischief maker at Singapore who appeared to have been set up there for the express object of writing down the English Rajahs and who by fair means and by foul, had gathered round him a considerable following. It is lamentable to see the Press worked for evil, as has been the case throughout this Bornean controversy. Having arrived at this or nearly at this conclusion, I felt that I might safely venture to visit Sarawak, and have any little doubt or obscurity connected with the Rajah cleared up on the spot. I found Sir James Brooke so far from being the miscreant represented, an able, enlightened, honorable and upright man. His people absolutely adored him. Moving about without any state or ceremony, he was received every where with delight; crowds marked his coming and looked brighter when he came. He needed no elephants of state, no guards of troops or horsemen, or even peon, no trumpets or tomtoms to protect his person, or add dignity to his presence. No crier proclaimed his rank, titles, or achievements—these were written in the hearts of his people. When the eye saw him it blessed him, those who came near him deemed it a privilege to be permitted to touch the hem of his garments. I saw him in his Court of Justice presiding in his shirt sleeves—my hearers must remember the heat of the climate—no crimson garments, or ermine, or mace,—he reminded one of the Patriarch Abraham sitting to do justice at his village gate. From his entrance to his retirement every eye was fixed on him, every word he uttered was greedily drank in by the ear. The Sultan of Bruni said to have such grievous complaints against him, had shortly before written him to this

effect,—'You can rule your country and keep it in peace and quietness, while I am unable to govern mine. Take possession therefore of the whole land from your border to the Rejaug river, and when you have put it in order, pay me any portion of the revenue you may think fit. The territory thus offered was about three times that Sir James Brooke himself possessed. I asked the people what they would do were Sir James Brooke to leave them— they said, we will all die, he is our father; every thing will be ruined if he goes away. Yet this is the man, who has been stigmatised and stripped of employment—a man entitled to rank with a Howard or a Washington, or any of the most illustrious patriots and philanthropists. He is now, as far as regards the British Government, no more than a private gentleman, living on his estates: our country has thus, through vile slander and falsehood, been deprived of services of the utmost value. The savages with whom he was compelled to deal severely, namely the Sarebus and Sukawan Dyaks are a portion of the most treacherous and cruel miscreants on the face of the earth, and as enemies of the human race, their extermination must be deemed a blessing to all around them. The favorite ornaments of their public places are piles or strings of human skulls. If they find a person, no matter of what sex or age, who never offended them, asleep they will take off his or her head at once, perhaps on the principle that then it would not be missed. When a man wants to get married, his favorite ornaments are human heads, dangling round his waist. When he dances with these before his bride, they bounce and jump about and this is deemed irresistible. A swain who has committed two murders is a hero. The character of the females of a country both fashion and indicate those of the males, and when the women only respect the murderer, it is impossible the men should be otherwise than ferocious. When warlike operations are undertaken, and there has not been slaughter enough to afford a skull to each of the parties engaged in them, the heads are cut in pieces, that there may be at least a fragment for each. One man secures a jaw or half a jaw, another half a head and the village which is without its supply of skulls is considered disgraced. Such are the peaceable and unfortunate fishermen, for whom the philanthropists of Exeter Hall solicit sympathy and compassion.

The whole of this remarkable Archipelago was marked with the most distinct traces of early Hinduism; great Hindu kingdoms had clearly flourished here at dates altogether unknown to us. We read in the travels of a Chinese Pilgrim, in the 4th century that Brahminism then prevailed in Java. I met, said Colonel Jacob, with the Lingum and Yuni in Borneo; the inscription now exhibited was found on a rock in Sumatra, it is in the Kawi language, and it was given me together with a translation by Mr. Friederich the learned Secretary to the Batavian Society—it proves the interesting fact to the Bhudhistic and Sivaistic faiths having been then united in that quarter. Java literally abounds in old temples, and rock and tree inscriptions some in the old Sanskrit character;—Hinduism fell in Java with the last Hindu King of Majapal it in the year 1478 the people had before that time been gradually converted to Mahomedanism, but they were still Hindu in their feelings, and

there still exists a remnant of Brahmins in the Eastern, and of Bhudists in the Western portions of Java. Driven from the throne of Java, the Hindus conquered and colonised the adjoining island of Bali, where to this day they present the singular spectable of a pure Hindu community, so far apart from the continent of India—divided into the four great divisions of Manu and their widows practising Sati. They possess only one Puran, the Brahmansa, and I trust Mr. Friederich will some day give to the world a complete edition of it in its Kawi text with translation. It would appear a legitimate inference from their possessing only one of the oldest Purans that the other seventeen were written subsequent to their establishment in the Archipelago. At Singapore a rock inscription, like that of Girnar, had been blasted and broken up for road metal. A few fragments of this had been picked up, just sufficient to shew what a precious treasure had been destroyed in our own time before our eyes. Judging from Malay annals it appears probably to have been the inscription of his conquests, engraved about the year 1200 by a Hindu conqueror, who stamped his name on the place, Singha puran, which it bears to this day; and coins, with the figure of a lion, have also, I was told, been found at Singapore. So little was known in reference to the earlier periods of Hindu history that every fact or date supplied, copper plate grants, coins, caves, sculptures, or rock inscriptions become invaluable. The store set by Indian antiquaries on this species of knowledge is well known. My friend near me Dr Wilson travelled four hundred miles on purpose to examine the Girnar inscriptions, Mr. Westerguaard came all the way from Denmark, chiefly for this purpose. Something like a history might be made out back to the date of Mahomedan conquest—beyond this all was darkness, with a few glimmering and scattered lights which yet might possibly be connected.

Passing from Borneo, Col. Jacob proceeded to give some account of his experiences in Australia, New Zealand, and Vandieman's Land, in Australia, New Zealand, the last named of these was now in the process of changing its name to Tasmania, from Tasman the celebrated Dutch Navigator, who discovered the Island, and had given it the name of the Governor of Batavia. A greater change had of late been brought about in New Zealand by the exertions of Missionaries, than had probably ever taken place in a similar time in any part of the world. Within these thirty years the people were cannibals, brave, cruel, and ferocious and though some of them might still have a hankering for a bit of human flesh to pick a white fingers, just in the corner; they had ceased the vile practice as a custom—feasting themselves of the slicked English sailors they still vastly were salt and fish. They were brave and romantically chivalrous, and it required a prudent Government to keep in order 100,000 people mostly with arms in their hands, and who knew how to use them. On one occasion during the late war when we were hemmed in by them, a convoy for us was intercepted and on this being discovered to be carrying provisions, these were sent on with a message, that the New Zealanders came to fight men, not to starve them. Whenever they proposed making an attack, they intimated beforehand the day and hour when they might be looked for, and seldom failed to keep their word. Of late years they have

been all converted to Christianity, and though their notions both of its doctrines and morals were often vague and loose, the change amongst them was marvellous. From the want of roads and thickness of the jungle, and having the advantage of navigable rivers, the inhabitants travelled chiefly in their canoes, and it was a beautiful spectacle to see of an evening the whole of them disembark and draw around the chief man of the fleet, while they knelt in prayer and sung a hymn. As might be expected, many of their original customs still clung to them, amongst which that of tabooing any thing meant to be set aside as sacred, was the most prominent. A tree, a road, a building, or an animal if once tabooed must on no account be touched, and the people were prepared to rise immediately to prevent or avenge interference. The practise of tattooing was getting into disuse, and was nearly extinct amongst the rising generation—the old men were all tattooed and this gave them a look of extreme ferocity—the women merely tattooed their lips, singular practice to render what should be softer than velvet, rough as a file. Many of the New Zealanders who had eaten human flesh in their youth, were now to be found employed under Government, some few were engaged in business, or even shareholders in Banks and Steam Companies. The country every where was in a state of prosperity, progression and promise, the only drawback the want of labour, and I must add, the pugnacious and somewhat indolent habits of the native. This improved state of matters was due almost exclusively to the Missionaries—these had laboured with much prudence and judgment. The British Colonies in Australia were in a state of extraordinary energy and progress. The convict system was now extinct, excepting in the Swan River districts, on the Western side of the Island, where the population was so scanty, that they were glad of convict labour. The city of Sidney, seventy years ago a forest, now contained seventy odd thousand of British population; and the progress of Melbourne was still more remarkable; its imports from 1851 amounted to fourteen millions sterling, and with all these colonies the amount could be little less than twenty millions annually, ten millions worth of gold had of late been sent yearly to Europe, and the wool trade was on the increase notwithstanding. A condition of things, such as this, commanded attention; the Australian colonies were not likely to suffer themselves either to be misgoverned or neglected. The various seats of Government were as distinct from each other as Calcutta, Madras, and Bombay, or even more so, and still more widely separated. Each had its own administration, its own revenue system, and its own Legislative Council. I, continued Col. Jacob, felt curious to see how the business and debates of these little Parliaments were managed, and must say, that the dignity and order observed in that of New South Wales would have done no discredit to Westminster; and made an English feel proud of his country. There were of course discontented spirits and malignants such as prevail d every where, the most conspicuous and troublesome being a Dr. Lang, a Presbyterian Clergyman, who led the democratic faction. But the mass of the people of that colony at any rate were loyal and contented, devoted to the mother country, and desiring no greater measure of independance than well governed colonists

might enjoy : and the same may be said of the others, with certain large exceptions in Victoria, of which Melbourne is the capital. Every thing in such places as this, especially human labor, was extravagantly dear ; common labour could earn ten shillings a day on the roads, and when such a price was paid for breaking stones, the rates of other kinds of industry might be guessed at. The gold diggings had for a time disturbed the whole system of things, and was scarcely more promotive of wealth than injurious to morals. A single anecdote will shew how completely the diggings were a lottery. A small party of men had secured a piece of ground on which they laboured for several months, digging down to the depth of 120 feet. They invested their all in a small steam engine, and pumped and dug and dug and pumped without finding any thing worth notice, until they had exhausted their capital and patience and were induced to abandon the enterprize to go elsewhere and begin the world anew. Some two or three men of lower orders rambling about that way, came upon the just abandoned hole, as such pits are called and resolved to try their luck. In a very short time after commencing work I believe a few hours only, they turned up eight pounds weight of gold in one nugget, worth four thousand pounds sterling. It was actually marked by the scratch of a pickaxe, so nearly had the original excavaters realized success when the work was abandoned. Australia would speedily become one of the most magnificent countries in the world, but for its want of rivers,—of these it has but one of any considerable size, the Murree which Capt. Cadel had, he told me, navigated a small steamer on for more than 1,400 miles. Its value remained still to be worked out. There are valuable establishments and farms on the Hunter river, and several other streams, but want of depth far from the mouth. There is considerable steam traffic between many of these and Sydney, and between the latter and Melbourne three large steamers run to and fro weekly. New Zealand and Tasmania have also steam intercourse with the mainland. Although there is great variety of ferns and flowers, the dull green of the one great forest tree—the gum tree—gives monotony to the landscape,—the tree is however useful, one species of the blue gum being preferred to teak for durability ; 400 different kinds of wood—mostly divers sorts of gum—were sent from Sydney to the Paris Exhibition, many of them beautifully grained and susceptible of the finest polish. One of the principal trees of New Zealand is called the kawri pines this also appears a species of gum tree, growing to a gigantic size,—at least a kind of gum, called kawri gum, exudes from it in appearance to the dripping of a wax candle in the wind. This gum, or rather gum resin is in great demand for the manufacture of varnish and other purposes, and it is often found in masses of several pounds weight. The kawri gum of commerce, though clearly the produce of this tree, is dug from the ground in quarters where no traces of forests now exist. [Colonel Jacob here exhibited specimens of both kinds, gathered from the tree and from the ground by himself.] The gum diggers probe the soil with long iron spikes and extract the gum thus indicated from generally a couple of feet below the surface. There can be no doubt that these pieces of gum are the relics of primeval

forests, which have disappeared so long ago that their exudations furnish the only traces that remains of them.*—Colonel Jacob concluded the lecture, of which we have been able to give but a very feeble outline, with some remarks on the extravagant expense of living, and the Yankeeism of tone amongst the servants, especially at hotels.—At the conclusion Colonel Jacob received the cordial thanks of the meeting, and as he had given but a mere fragment of his experience, a hope was expressed that the Society might be favored with a continuation of these when a special meeting would be held if deemed requisite.

We subjoin a letter from Colonel LeGrand Jacob, containing some explanations in reference to the report of the proceedings of the Geographical Society:—

"On reading over your report of my lecture at the Geographical Society, I perceive two or three points calling for explanation. I very probably used the language attributed to me, for as an abstract of what I said, your report is most correct, but if so, I take the opportunity of correcting myself, lest erroneous impressions go abroad.

Speaking of Sir James Brooke, I had no right to use the term "stripped" of employment, the fact being that he himself resigned all connection with the British Government on ascertaining that they had given way to the clamour against him—the previous deprivation of the Governorship of Labuan, was based on the insignificance and poverty of that place, and as this was done so as not to hurt his feelings, confidence being at the same time exhibited, by entrusting him with the general control over British interests in Borneo, the word "stripping" is not therefore suitable, though the results have been the same.

Whilst alluding to Sir James, I may as well say a few words on the Commission, notice of whose report came by the Mail two or three days after our meeting. I cannot help thinking that the Commissioners, Mr. Prinsep especially, have mistaken Sir James Brooke. As far as I understood him, and I had more conversation with him than they had, his idea of the incompatibility of the union of British and Local power, was not in the abstract, but with reference to the actual appointment that had been conferred on him, and restrictions imposed on him. I feel persuaded that were Sir James invited by the Government to point out in what way he could best serve both national and local interests, he would find no difficulty in doing so, and in showing how harmoniously they could work together.

It is a fact to my limited reading unprecedented in history, that a State policy approved of by different successive Governments, should on further change of ministry, be submitted for the opinion of private individuals, at a distance from the records of those governments, and from the various sources of information actuating them in their policy. The appointments of Sir James

* This is exactly the case with the dammer we use on our roofs, which is brought from Singapore and with benjamin, gum animi, and other valuable gums imported from Zanzibar. It is strange that of the origin of substances at once so valuable and so familiar to us so little should be known.

were based on the fact, that he possesses great influence in that quarter of the world, whereby British interests would be more surely advanced than if entrusted to another without such prestige and influence, and I will ask has not Sir James advanced British interest? Is not the coal of Borneo at our disposal through him? has not piracy been suppressed, but not extirpated I am sorry to say owing to his want of means by him?—why Sarawak alone contributed in 1853 to the general trade of the empire, 30,000 tons, and each year there is an increase of Gutta percha and other valuable products, whereas during the days of anarchy, the trade with Borneo was a mere nothing. The English Raja has all along been anxious to place his country under the ægis of Great Britain, and it is no fault of his that his offers have been rejected.

There is room for difference of opinion as to the aforesaid state policy; some men might use British power to advance their own ends, and some might use Local power to advance national interests. The Commissioners themselves appear to have taken different views of the subject!—had they visited Borneo as I did, and seen the good done and the influence wielded, their opinions would probably have been modified. The result of the Commission as far as I can judge from the meagre account that has reached us, will be injurious to our national interests. Sir James Brooke's character will doubtless be cleared from the imputations that unprincipled and misguided men have cast on it, but I doubt whether national benefit will accrue from the doubt thrown on the compatibility of British and Local power."

My letter has already exceeded the bounds I destined for it, and I will therefore address you on the other subjects of your report to-morrow.

Colonel L'Grand Jacob thus continues his remarks on our report of the Geographical Society's Lecture :—

"The second point to which I wish to allude, is the overestimate given of Missionary labors in New Zealand. The benefit conferred by this worthy class of men, should be reported applicable only to the Native community and not as may be inferred from the text, to the general condition of the country, the improvement of which is due chiefly to Anglo-American energy and capital. Moreover the term Missionary is too elastic for [illegible] man has done more for the Maori population or stands higher in their estimation than Bishop Selwyn, whose exertions and self-denying character I alluded to in my lecture.—The transition from the Conifer of Australia to the Kowrie gum resin, may have made me appear [illegible] but the Kowrie pine belongs to a different family. In speaking [illegible] Sumatra, I mentioned the surprising fact [illegible] harbours, accessible to ships of the first class [illegible] surveyed by the Americans, and charts published for the benefit of the world—Whilst I was in the Java seas an American ship of war was employed there on Survey, but the extent of their labors in that quarter I am ignorant of. There are a few trifling mistakes such as tattooing for tattooing, th

Murree River for the Murry, &c., but they are not of sufficient moment to induce me to trespass longer on your patience."

ART. VI.—*Globular Lightning, Fireballs of the glow discharge of Electricity contradistinguished from the Meteorolytes or Fireballs usually composed of solid matter.*

The Royal Society of London in a reply to letter from the Lords of Admiralty on marine meteorological observations, make the following remarks on the subject of Globular Lightning—and as there is reason to believe that this phenomenon is of much more frequent occurrence in India than in most parts of the world, and as Electric fire balls are often confounded with or mistaken for meteors, the matter forms subject of remark fitted to follow what has already been said in a previous number.

In recording the phenomena of thunder and lightning it is desirable to state the duration of the interval between the flashes of lightning and the thunder which follows. This may be done by means of a seconds-hand watch, by which the time of the apparition of the flash, and of the commencement (and of the conclusion also) of the thunder may be noted. The interval between the flash, and the commencement of the thunder, has been known to vary in different cases, from less than a single second to between 40 and 50 seconds and even on very rare occasions to exceed 50 seconds. The two forms of ordinary lightning, viz. zigzag (or forked) lightning, and sheet lightning should always be distinguished apart; and particular attention should be given both to the observation and to the record, in the rare cases when zigzag lightning either bifurcates, or returns upwards. A special notice should not fail to be made when thunder and lightning, or either separately, occur in a perfectly cloudless sky. When globular lightning (balls of fire) are seen, a particular record should be made of all the attendant circumstances. These phenomena are known to be of the nature of lightning, from the injury they have occasioned in ships and buildings that have been struck by them; but they differ from ordinary lightning not only by their globular shape, but by the length of time they continue visible, and by their slow motion. They are said to occur sometimes without the usual accompaniments of a storm, and even with a perfectly serene sky. Conductors are now so universally employed in ships, that it may seem almost superfluous to remark that, should a ship be struck by lightning, the most circumstantial account will be desirable of the course which the lightning took, and of the injuries it occasioned; or to remind the seaman that it is always prudent, after such an accident has befallen a ship, to distrust her compasses until it has been ascertained that their direction has not been altered. Accidents occurring *on land* from lightning will, of course, receive the fullest attention from meteorologists who may be within convenient distance of the spot.

It is unfortunate that the instructions should not have been more specific, as to how the fire-ball—that is electricity assuming this form, and exhibiting itself, under the aspect of the Glow-discharge,—should be distinguished, from the fire-ball, or meteorite with which it is so constantly confounded. We have three distinct forms of luminous meteors, commonly so called—of course not including in these, Auroras, Swamp lights, or the general class of luminous appearances, on the face of the earth or of the heavens—which are too often confounded together, and betwixt which, broad and clear distinctions, are to be drawn. The first of these that may be noticed is what is called the falling or shooting star. It is a bright spark of light—shooting across the sky, generally a considerable way above the horizon, and which to the eye, appears at no great distance, up from the surface of the ground. It seldom varies either in size or form, during its flight. It appears and disappears at once, without explosion and without leaving any track behind it. It does not seem to the eye, to be possessed of any bulk, or to consist of solid matter—in all these respects differing as widely as possible from the true fire-ball or meteorite.

The meteorite always increases in magnitude and brilliancy as it rushes along, being brightest and largest just before disappearance. It has generally a lambent-flame-like aspect closely resembling that of the star of a rocket. To the eye it looks like a great ball or disc of fire. It very often seems to shoot across in jerks or bounds, as if retarded or arrested at regular intervals, and then starting afresh. Some times it seems to librate, assuming the aspect of a or discus or a quoit in the air—shewing at intervals its face at intervals its edge to the spectator. It is probable that both sets of appearances, which it would be so hard otherwise to explain, on any of the ordinary known physical laws, may be due to some optical illusion. The meteorite generally explodes—blazing out with unusual brilliancy just before its bursting. The fragments commonly proceed onwards for some space in the line of the meteor—descending in parabolic curves towards the earth with the motion of the mass now detached into pieces—being in all probability retarded, in part by the concussion of bursting, partly by the resistance of the atmosphere. The sound of the explosion is frequently heard at great distances—like the firing of a heavy gun—and in numberless cases, fragments of the meteorite have been seen fall or been found. The probability is that in all cases, this form of luminous meteor, contains a *nucleus* at least of solid matter. It is probable, that this on coming within the region of the earth's atmosphere is partially fuzed or ignited,in consequence of the speed, at which it rushes along. In many cases, it bursts and falls to the ground in fragments In others in all probability it is burned into ashes,and in this form diffused for a time through the air. It is not unlikely that most of these Planetoids, if Planetoids they be, after for a time manifesting themselves, escape from the atmosphere and once more pursue their appointed course.*

* The following is the usually accepted theory of Meteors, from Humboldt's Kosmos.

"The different meteor streams, each of them made up of myriads of little

Electric Fire-Balls.

I have never happened to see any exhibition of this form of luminous meteor—but from the accounts given of it—it appears in general to be sufficiently distinguishable,—as it is most important that it should be distinguished—from that just described. It seems almost invariably to be concomitant with a violent thunderstorm of the ordinary character, or to be preceded or accompanied by strong electric manifestations in the air—Its motions are at all times slower, much, than those of the meteorite, though it is only when the one actually breaks into fragments, or the other explodes on coming in contact with any imperfect electric conductor, that we have the means of ascertaining positively, the true character of each. There is no reason why a meteorite should not make its appearance, during a thunderstorm as much as during any other state of the weather—but as these bodies are believed to be extramundane, it is opposed to our conceptions of their character that their appearance within our atmosphere, should be in any way affected by any atmospheric commotion. If then it be kept in view how frequently meteors are described as appearing during thunderstorms—and how very small a portion of the whole year, these storms actually occupy, the conclusion seems inevitable, from the undue proportion betwixt the two that the great bulk of what are described as meteors occurring in thunderstorms, are

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planets, probably intersect the orbit of our earth in the same way as Biela's comet does. Upon this view we may imagine these shoot-star asteroids as forming a closed ring, and pursuing their course in the same prrticular orbit. The smaller telescopic planets between Mars and Jupiter, with the exception of Pallas, present us, in their closely connected orbits, with a similar relationship. It is impossible as yet to decide whether alterations in the epochs at which the stream becomes visible to us, whether retardations of the phenomenon, to which I long ago directed attention, indicate a regular recession or change of the nodes (the points of intersection of the earth's orbit and the ring) or whether from unequal clustering or very dissimilar distances of the little bodies from each other, the zone is of such considerable breath, that the earth only passes through it in the course of several days. The lunar system of Saturn likewise shows us a group of most intimately associated planetary bodies of amazing breadth. In this group, the orbit of the 7th or outermost satellite, is of so considerable a diameter, that the earth, in her orbit round the sun, would take three days to pass over a space of like extent. Now, if we suppose that the asteroids are unequally distributed in the course of one of the closed rings which we picture to ourselves as forming the orbits of the periodic currents, that there are but a few thickly congregated groups such as would give the idea of continuous streams, we can understand wherefore such brilliant phenomena as those of November 1799 and 1833 are extremely rare. The acute Olbers was inclined to announce the return of the grand spectacle, in which shooting stars mixed with fireballs should fall like a shower of snow, for the 12th—14th of November, 1867.

Hitherto the current of the November asteroids has only been visible over limited portions of the earth's surface. It appeared, for example, with great splendour in England in the year 1837, as a meteoric shower; whilst an experienced and very attentive observer at Braunsber in Prussia, saw nothing more than a few scattered shooting stars in the course of the same night, from seven o'clock in the evening till sun rise, the sky having continued un

simply manifestations of ball lightning. It is singular that a man so industrious and observant as Dr. Purdy Thompson, should have written so indistinctly on a subject, where clearness was of so much importance. In his introduction to meteorology ch. xiii he says :—

"Fire-balls occasionally accompany meteoric stones in their descent; nevertheless, these phenomena must be considered independent, for the boils may appear without the meteorolite, and *vice versa*. Various theories have been proposed to account for them but that which seems to be most tenable assigns their origin to electric agency. Halley conjectured an origin remote from our earth, for, referring to the Bononian meteor of 1676, he observes, that he was 'induced to think that it must be some collection of matter formed in the ether, as it were by some fortuitous concourse of atoms, and that the earth met with it as past along in its orbit.'"

"Priestley takes notice of a fire-ball, said to have been "as large as a millstone," which was seen at sea, in lat. 42° 48, and W. long. 9° 3, from the *Montague*, on the 4th November 1719; it broke with a violent crash, the main top-mast being at the same moment shattered, and strong sulphureous smell perceived; five seamen were thrown down, and one much hurt. We are disposed to class this meteor, which was seen rolling upon the sea like a large blue ball, with ascending thunderbolts, rather than with fire-balls.

"Three are recorded in the following year by Mr. Bennet :*—one of them occurred in July, during a thunderstorm, which was as big as a man's head, and fell into the ocean near the ship : the second was on the 7th September,

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interruptedly clear the whole of the time. Bessel concluded from this, "that a group of the great ring which is occupied by these bodies, of but limited extent, had approached the earth over England, whilst districts to the east passed through a relatively empty portion of the ring" (16). Should the idea of a regular precession or variation of the nodal lines, occasioned by perturbations, acquire greater likelihood, the discovery of older observations of the phenomenon would become a matter of particular interest. The Chinese annals, in which, beside the appearance of comets, there are also notices of great showers of shooting stars, go back beyond the time of Tyrtæus, or the second Messenic war. They describe two streams occurring in the month of March, one of which is 687 years older than the commencement of the Christian era. Edward Biot has already remarked, that among the fifty-two appearances which he finds recorded in the Chinese annals, the most frequently recurring were those that fell near the date from the 20th to the 22d of July (old style), which may very possibly be the now advanced stream occurring about the time of the feast of St. Lawrence (17). If the great fall of shooting stars which Boguslawski, jun., finds recorded in Benessius de Horowic's "Chronicon Ecclesiæ Pragensis," as having been seen in full day light on the 21st of October, 1366 (old style), corresponds with our present November fall, the precession in the course of 447 years informs us that this shoot-stars system (that is to say, its common point of gravity), describes a retrograde course about the sun. It also follows, from the views now developed, that when seasons pass by in which neither of the streams as yet observed—that, namely, of November and that of August,—is seen in any part of the earth, the reason of this is either in the interruption of the ring—in other words, in the occurrence of gaps or vacancies between the clusters of asteroids that follow each other, or, as Poisson will have it, in the influence which the larger planets exercise upon the form and position of the ring (18)."

it had a red colour, and passed from E. to W., disappearing in the offing, "with the glowing hue of intensely heated iron;" the sky, which was serene at the time, became cloudy and heavy rains began to fall: the third appeared on the 18th of the same month, having an apparent diameter equal to the moon, and an easterly course from the zenith; it burst and fell with great velocity among the waves.

"Upon the 2d of January 1825, about 2 A. M., a curious luminous meteor was seen by M. Antonio Brucalassi, on his return to Arezzo, between S. Giovanni and Montevarche: it appeared suddenly about ten fathoms from the ground, and apparently not far off, in the form of a truncated cone. It seemed a mass of fire, which by its rapid motion left a track of light that gave it the shape described; sparks of great brilliancy were given off as it moved from W. to E. with a rapid motion. The entire length of the meteor appeared to be two fathoms, and its diameter at the base half a fathom; during its continuance it shed a most effulgent light. The sky was clear at the time, the atmosphere was calm and cold, and both before and after this meteor, many shooting stars were witnessed.*"

To me it appears quite clear that all the fire-balls here enumerated were examples of ball lightning.

In an account of the meteors observed in India in the year 1850—forwarded by me to Professor Baden Powell and published in the Reports of the British Association for that year, there are three which I have described as meteorites, which further reflection has convinced me were electric fire-balls.

"We have had three instances this season of what seems to have been the fall of an aerolite during thunderstorms. On the 25th of September a violent explosion occurred in the air at Bombay, followed by a wild rushing sound overhead, heard at various points over an area of thirty miles in length and eight in breadth, followed by a severe concussion, as if a heavy body had fallen, just before the occurrence of which a large fire-ball was seen plunging into the sea. On the 18th of March, during a violent thunderstorm near Dhutmah in the north-west provinces, at seven P. M., a thunderbolt, as it was called, was seen to fall and strike the ground, giving out in the course of the concussion a clear ringing sound like the crack of a rifle; there was no echo or reverberation at all like thunder. It appeared 150 yards from Choki, and resembled in its descent a huge ball of red-hot iron with a band of fire estimated at about thirty feet in length. On the 30th of April, about midnight, a violent explosion was heard during a storm of wind and rain at Kurrachee, resembling the discharge of a vast artillery battery, and about half a minute afterwards a meteor, partially obscured by the rain, but still distinct and visible, was seen descending into the sea. It is now well-established that in India at all events earthquakes are almost always accompanied by furious storms of thunder, lightning, wind and rain: it is difficult to trace the cause of coincidences so remarkable in the commotions of the earth and air, still more so to imagine any connection whatever betwixt the perturbations within the limits of our atmosphere and the movements of solid bodies entering it from regions beyond its boundaries; yet it is surely possible to suppose a thunderstorm propitious to the precipitation on the surface of the ground of bodies which might otherwise have passed on in their career."

The following notices of Glow discharge leave no room for misinterpretation—they might be almost infinitely multiplied from our ships' logs and newspapers.

"On the 16th of June 1[illegible], a tremendous thunderstorm was experienced at

* [illegible], Lib. Ital. Ann. di Fisic. xxvm. 75.

Masulipatam. The lightning was terrific, and in the height of the storm the electric fluid struck a bungalow in which were three gentlemen. It is described as "appearing like a ball of fire, which almost immediately burst with the report of a 14-inch shell." The roof of the bungalow was thatched, consequently the whole house was burned to the ground in a very short time. It may be considered as little short of a miracle that no one was hurt materially; the gentlemen who were in the bungalow contrived to make their escape, but they were so stunned that they heard no thunder afterwards, though it is described as having been tremendous."—*Madras Courier, June* 29.

"*Earthquake on the Eastern Coast.*—An earthquake, a phenomenon very unusual, we might, we believe, say almost unprecedented in this part of India, occurred on the 16th June in various parts of the Peninsula. We have heard that it was experienced in a slight degree at Pondicherry and at Pulicat, and an obliging correspondent in the district of Coimbaconum, has communicated to us some account of this extraordinary occurrence in that quarter. He justly observes, "it may not be uninteresting to hear that one took place on the evening of the 16th instant at Triviar in this district. In our account received from the district Moonsif he states, that at about half after seven P. M. when holding his cutcharee, the earth suddenly became convulsed; that all present became as if intoxicated, and could not stand, that the pillars of the building shook and threatened its destruction; boxes, &c. were moved from their places; that the pagodas and town remained in motion for about four minutes. He states that the tenedar was also at his duties at the time, and was thrown down, as was also the peon who went to assist him. These persons, with many of the town people, experienced violent vomiting, but no accident happened. So little known is such a visitation, that the Moonsif quotes his Hindoo Shasters as foretelling that an earthquake would *sometime* happen. The state of the atmosphere before and after the shock is not mentioned, nor whether it was attended with any noise."—*Madras Courier.*

[This it will be remembered was the date of the tremendous Earthquake which spread destruction over North Western India.]

In October 1820, when a small party were assembled, early in the evening, in a boarding house in Westwood, near Bristol, they were struck with a bright light through the window, and on looking out, saw a fire ball, seemingly about a foot in diameter, descend towards the ground within ten yards of them, and then shoot for about 20 yards along a hedge, when it disappeared without either hissing sound or explosion.

"During a violent storm of rain, in June or July 1832, about 2 P. M., a ball of fire was by many persons seen to descend on the roof of Sir Colin Halkett's house "Non-Parell" (near Parell), exploding with a loud report. It appeared to striked the northern extremity of the main beam of the roof, which was shattered into splinters: the electric fluid then passed through the walls into the rooms of the northern wing of the building, some of the window frames, which had been protected by iron bars, being forced out of the masonry. The lightning then appeared to run through and along the walls of the bedrooms and drawing room: the latter were painted in pannels yellow with white borders, the white borders appearing the chief attraction, the yellow being untouched, or vise versa. Some mirrors and pictures hanging against the wall were broken and scorched the gilt frames remaining untouched. Some of the lower rooms of the north wing contained several presses full of glass ware, and some plate chests: the former were more or less broken—one of them as if a shell had burst inside, leaving scarcely a fragment the size of one's hand: others were less broken, but while all, or nearly all, the white glasses in these latter were broken, the green hock and finger glasses were mostly uninjured. The plate chests had their locks and iron bands wrenched

open, and the silver articles were more or less tarnished—in one of the chests the upper tier of spoons was scratched or notched as if by a file. Several persons of the establishment present in the north wing at the time were injured, and one or two were found insensible, but no one was seriously injured. In one of the glass windows in the back veranda (stained green,) there was a clear round hole, as if cut by a pound ball. The family were fortunately at the time in the southern wing of the house, and Major Bonamy, who had a penknife in his hand, felt a smart shock. I* was not in the house at the time, but arrived there an hour or two after the occurrence, and witnessed the results, an account of which I have given from memory."—*Transactions of the Bombay Geographical Society* Vol. IX. p. xxxviii.

A letter was read before the Royal Society of London giving an account of "An Explosive Meteorite." By Fancis Higginson, Esq., R. N. Communicated by Thomas Bell, Esq., Sec. R S. &c Received December 23, 1852.

The writer states that his attention having been aroused by the highly electrical state of the atmosphere during a severe gale of wind, he proceeded along the beach in the vicinity of Dover, at 2 A. M. on the morning of Friday the 17th of December 1852.

"It had blown very hard during the night, the wind veering from West to W. S. W., in occasional heavy squalls of rain and sleet, accompanied at intervals by faint flashing scintillations, which at first, being considered sheet lightning, were only noticed from their unusual colour, a deep and sombre red. At about 4h 50m A M., however, these flashes constantly emerging from a dense, triangular and very remarkabe cloud in the S. E., which perceptibly increased in size with great rapidity, he was induced to observe it with minute attention. At 4h 55m A. M., Greenwich mean time, the cloud had assumed the form of a right-angled triangle, its hypothenuse, or longest side, tending east and west. At this instant he first heard a singular and extraordinary hissing sound in the air, not unlike that of a passing shot, which, although at first not very loud, was yet clearly distinguishable above the howling of the gale. At 5 A. M. the cloud had nearly doubled its original size, advancing steadily from the S E. in a N. W. direction, or from nearly dead to leeward, towards the wind's eye ;whilst the scintillations spoken of were emitted with increased rapidity. He also then first perceived in the centre of the cloud, a dull, red, obscure nucleus, or fire-ball, apparently about half the diameter of the moon, having a tail five or six times that length, from which the flashes mentioned were sent forth, surpassing brilliancy, as the meteor clearly descended with great velocity through the air, accompanied by a detonating, hurtling, hissing sound, impossible to describe, yet resembling that which precedes the shock of an earthquake. At three minutes past five o'clock A. M. the meteor having apparently spanned the Channel from S.E. to NW., upon approaching the land—evidently throwing off portions of its substance as it passed through the atmosphere—the nucleus suddenly exploded with a report similar to a very heavy clap of thunder, giving out an intensely brilliant light, which rendered the minutest objects distinctly, visible, although it rained violently and the sky was obscured by dark and threatening clouds. The dense body of the meteorite seemed to fall in the water about half a mile from the land, as indicated by a great volume of spray, which rose foaming in the distance."—*Reports of Royal Society* 1854.

"PENANG—About ½ past 5 o'clock on the evening of the 30th Sept. 1856 the residents towards the western extremity of Northam road were startled by a flash, or as some of them describe it a blaze or gush, of lightning such as they had never before seen, followed immediately by a single terrific explosion. The

* The writer of the work (Lieut. H. H. Godwin) 2nd Quarter Master General, Bombay Army, in 1822, A.D.C. to Sir C. Hallet.

flash was seen like a ball of flame to strike the top of a cocoanut tree on the side of the road opposite the Raja of Ḳidah's house. It set fire to the loose fibrous matter which continued to burn for about three hours."—*Singapore Paper.*

SINGULAR OCCURRENCE.—"About 5 o'clock p. m., on Thursday 31st Oct. 1850 the Ellen Anne, London and Lanelly trader, when making for the latter port, was struck by a meteoric substance. When the event took place, the vessel was about 10 miles S. by W. off Caldy Island. The day was dull and lowering, with the wind fresh, Captain Evans at the moment was below in the cabin, and was startled by the report, which he says sounded to him just like a musket charge, and that he thought the boys were playing upon deck with gunpowder unknown to him; but finding he was mistaken, his attention was drawn to the planking, four of which had been torn out of their places and perforated about 3 inches deep in many spots, which appeared like musket-shot holes, and were all more or less singed. No signs of a thunder-storm were to be seen or heard. Such an occurrence is very rare in the Bristol Channel, although frequent up the Mediterranean. Captain Evans says it is the first one he ever heard of in the former waters."—*Times.*

APPENDIX A.

GEODOSEY.

Successful Measurement of a Base Line.—Ceylon.

The measurement of a Base Line by the Surveyor General's Department has just been completed, which it is hoped will preclude the necessity of repeating so tedious an operation in this Colony for many years to come. The length is about four miles and a half, and the work has occupied a considerable force for about three months. The operations have been conducted by Color Serjeant Winzer, Royal Engineers, assisted at intervals by the Surveyor General himself.—Some idea of the severity of the labor the officers of the Survey Department have to undergo, may be formed, when we state, that the temperature recorded during the process was sometimes 124 degrees. To eliminate the effects of tension on rods under various temperatures and of the expansion and contraction of the different substances used in the standard and measing apparatus, requires delicate calculations which must occupy some time: the true length of the line therefore cannot be known at present; but the precautions adopted for verification at certain stages and the confidence felt by the Surveyor General in Serjeant Winzer's ability and accuracy, it is understood, leave Capt. Gosset no room to doubt that the result will be other than—a base suitable for all scientific requirements, ergo, (and *which we care for more,*) for every *practical* purpose for the next century or two. Let due honor, and such rewards as Government can afford, be accorded to those who risk health and life in the public service. The Colony does not grudge the liberal Salary drawn by Capt. Gosset: if he is paid well he works hard. We are not aware of the position occupied by Serjt. Winzer; but we hold that a man whose labours are so severe and in whom so much confidence is reposed ought to be liberally remunerated.—*Colombo Observer, Oct.* 1857.

APPENDIX B.

METEOROLOGY.

A curious phenomenon observed last spring at Matheran has just been brought to our notice. Early in April the well on the hill began to fail, and by the middle of the month they had nearly dried up. On the 20th of April about full moon, we had a weather crisis with much lightning in the air, contemporaneously with a hurricane in which the steamer *Queen* on her way from Aden was so nearly lost and at this juncture all the wells but one filled at once. In a week or so they once more ebbed away when at the following full moon 20th of May coincidently with a violent thunderstorm at Ceylon the very same phenomena made their appearance. On both these occasions there were slight showers of rain, nowhere sufficient to establish the most tiny rivulet, or to penetrate more than two inches into the soil and therefore incapable altogether of affecting the springs. The facts we have stated are fully authenticated, and the phenomena described are altogether new As it often happens, however,

that marvellous things are noticed without being made known to the world, if any such have been observed elsewhere, we shall be grateful for any information regarding them. It is only by collecting large groups of facts that we can ever expect to construct theories at all.—*Bombay Times.*

We observe by a curious coincidence that the Royal Geographical Society of London have just published a list of Hurricanes of the West Indies in nearly the same manner, and at the same time, as the like service to Meteorology has been performed by our Local Association for the East Indies.—The following curious contrast in the results presents itself:—

PROPORTIONS OF HURRICANES OCCURRING IN EACH MONTH.

	West Indies.	*East Indies.*
January	5	0
February	7	0
March	11	1
April	6	5
May	5	9
June	10	2
July	42	4
August	96	5
September	80	8
October	69	12
November	17	9
December	7	5

The West India list extends over three hundred years, commencing with 1493, giving a table of four hundred hurricanes, of three hundred and sixty-five of which only are the dates made known. The Bombay list extends over a century, but as it could only be made anything like correct for the space of twenty-five years, the abstract is deduced from those occurring betwixt 1830 and 1854, to the north of the line and betwixt the meridians of Canton and Kurrachee. We find that in the West Indies, a hundred and eighty-eight hurricanes have occurred within the present century, or at the rate of 3.5 annually. In our seas sixty-one have been recorded during the past twenty-four years, or on an average of 2.5 annually. The space over which our review extends, includes the singularly tranquil waters of the Arabian Sea, and excludes the great hurricane track of the Mauritius. We beg to remind the Meteorologists of these islands, that it is a debt they owe to Meteorology, to provide some such catalogue and abstracts as those just indicated, for the notable localities around them. From the extraordinary frequency with which hurricanes are set down as having occurred of late, compared with former years, we suspect that old records have been very imperfectly kept. Bermuda, well deserving the designation of

"Still vexed Bermuthes,"

seems at times to be in a state of almost perpetual tempest. Betwixt the 22d October and 9th November 1854 it was thrice swept by hurricanes, and twice betwixt the 21st of October 1854 and 10th of February 1855. Our great hurricane months in the East Indies, are October and November—in the West, August, September, and October. The three first months of the year seem to be comparatively tranquil every where. A few additional lists, such as we have been discussing, will soon enable us to discover whether there are not regular returns of hurricanes after certain periods of years, and whether moreover the occurrence of hurricanes at certain seasons in one part of the world may not give reason to expect their appearance at a coincidentally or at determinate intervals in other parts. We may in conclusion remark, that two very important works bearing on these points, are set down for the consideration of the Bombay Geographical Society, which resumes its ordinary meetings on the 21st instant, after the customary monsoon vacation.—*Bombay Times.*

SINGULAR PHENOMENON.—The following letter, from the Hon. Charles Augustus Murray, H. M. Envoy to Persia has been handed to us (*Literary Gazette*) for publication by Sir Charles Lyell:—

"Baghdad, May 23, 1857.

"My dear Sir Charles,—We have lately witnessed here a phenomenon so strange, that a brief description of it may not be uninteresting to you. On the 20th instant, a few minutes before six p. m. (which is here about an hour before sunset), I was sitting with my mirza reading some Persian letters when on a sudden I became sensible of an unusual obscuration of the light on the paper. I jumped up, and going to the window, saw a huge black cloud approaching from the north-west, exactly as if a pall were being drawn over the face of the heavens. It must have travelled with considerable rapidity, for in less than three minutes we were enveloped in total darkness, a darkness more intense than an ordinary midnight when neither stars nor moon are visible. Groping my way amidst chairs and tables, I succeeded in striking a light, and then feeling assured that a simoon of some kind was coming on, I called to my servants to come up and shut the windows, which were all open, the weather having been previously very sultry. While they were doing so, the wind increased, and bore with it such a dense volume of dust or sand, that before they could succeed in closing the windows the room was entirely filled, so that the tables and furniture were speedily covered. Meanwhile a panic seized the whole city, the Armenians and other Christian sects rushed through the gloom to confess and pray in the churches; women shrieked and beat their breasts in the streets; and the men of all classes prostrated themselves in prayer, believing that the end of the world had arrived. After a short time the black darkness was succeeded by a red lurid gloom, such as I never saw in any part of the world, and which I can only liken in imagination to the effect that might be produced if all London were in conflagration in a heavy November fog; to me it was more striking (I may almost say fearful) than the previous utter darkness, and reminded me of that 'darkness visible' in which the poetic genius of Milton placed the demons and horrid shapes of the infernal regions. This lurid fog was doubtless occasioned by the rays of the western sun shining obliquely on the dense mass of red sand or dust which had been raised from some distant desert, and was borne along upon the blast. I enclose you a specimen of the dust. The Arabs here think that it came from the Nejd. The storm seems to have travelled in a circular direction, having appeared first from the south, then south-west, then west, then north-west After about two hours it had so far passed away that we were able to open the windows again and breathe the outer air. It cannot have been a simoon, for during those which I have experienced in Arabia and Egypt the wind is hot and stifling. On the 20th the wind was high; but only oppressive from the dense masses of dust that it carried with it.—I remain, &c. "CH. A. MURRAY."

Professor J. Quekett, of the Royal College of Surgeons, having kindly examined the specimen of red dust from Baghdad, which accompanied Mr. Murray's letter, has informed Sir Charles Lyell that he could detect, under the microscope, only inorganic particles, such as quartz-sand, in the dust. There are no relics of diatomaceæ apparent; and though a small portion of calcareous matter was present in the sand, yet he could observe no microscopic shells or other organic matter.—*Literary Gazette.*

SINGULAR SAND STORM IN THE DESERT.—SIR,—In confirmation of the graphic description given by the Hon'ble Mr. Murray, in his communication to Sir Charles Lyell, respecting the strange phenomenon "witnessed at Bagdad on the 20th of May last," I take the liberty of forwarding you a few lines. At noon on that day, I took my departure from the town of Hillah, accompanied by my private servant and an escort of four armed men, which had been placed at my service by the Pasha of Bagdad on my leaving that city a few days previous. After visiting, and carefully examining the mounds, &c. to the north-west of Hillah, I proceeded very leisurely on my return-journey, wrapt in contemplation concerning the extraordinary relics of departed greatness which I had so recently been inspecting. At the outset of my journey, I purposed getting over, if possible, half the distance I had to travel, before halting for the night,—simply resting for a short time at the first caravanserai to refresh myself, my horses and attendants; but when about nine miles on my road, I was struck with the change which had taken place in the state of the atmosphere, which, from being cool, buoyant, and agreeable, had become close, heavy and oppressive. I then—it was about

¼ past 5 in the evening—first observed the strange alteration in the appearance of the sun, whose rich golden colours were changed to a most remarkable, sickly, silvery hue; from the south-west, occasional puffs of hot air came sweeping across the desert; and from the same direction, I could plainly perceive the rapid approach of what appeared to be masses of dark clouds, of a purplish red colour. These indications were quite sufficient to warn me that some singular atmospheric disturbance had occurred, and as I did not at all like the ominous appearance which "Dame Nature" had so suddenly assumed, I called out to my escort and servant, who were slowly following in the rear, to hasten on; and putting my horse into a canter, hoped to reach the caravanserai before the *storm* burst upon us. In this I was grievously mistaken,—I had scarcely proceeded two hundred and fifty yards, when a dull, low, portentous howl preceded a frightful black mass, and immediately I was enveloped in appalling darkness! Anything more singular, sudden, or alarming I had never before witnessed. The darkness was indescribable,—the term *Egyptian* may convey some idea of it. The wind howled a dismal concert over the bleak wilderness driving in its course a peculiarly fine dust, which soon rendered respiration painful act. One of my escort—a very intelligent Arab—had come up within five or six yards of me, and *guided by the sound of my voice*—in replying to his repeated cry of "Sahib"—got close to my side. In a moment we had completed the very few, inadequate, and simple arrangement in our power:—placing our horses to windward of us, we secured them by a piece of rope, and stretching ourselves at full length on the ground, covered our heads and shoulders with—all the extra covering we could muster,—a sort of camlet belonging to my companion, who moaned, and prayed to Allah most vigorously, his devotion, however, being seriously disturbed by an almost constant cough which the fine dust had induced. I found an extempore respirator,—a handkerchief bound round my mouth,—very serviceable, but for the perpetual *sneezing* which was excited, I could find no relief. With our heads thus buried in the dust, which was rapidly accumulating round us, with very light covering, no water, and perfectly ignorant as to the duration of our arrest, our situation was infinitely more peculiar than pleasant; indeed, I do not think that any *description* would enable you to realize a faithful idea of the solitary, dismal, and depressing nature of it. For *three hours* we were thus posted, only moving when it became necessary to dodge the wind, so as to avoid the insinuating dust as much as possible; but all things, dull stupid letters included, have an end, and so, Sir, had this "phenomenon." I only wish it had found *me* "reading Persian letters," or any other, in a cool comfortable house in Bagdad, rather than where it did. I offer no comment, or explanation of this atmospheric row, but I am told that such are "quite common" on the frontier of Upper Scind; —if we are to credit all that we hear of that same Scinde, it must be strange place; but Sir, in the land of my nativity there is an odd old saying,—"*Cows far off, have long horns.*"

The "oldest inhabitant" of Bagdad had never seen, or heard of, any thing of the kind before.—I am, Sir, your obedient servant.

A. W. R.

Seroor, 21st September, 1857.—*Bombay Times, 3rd Oct.*

METEORITES IN BENGAL.—The last number of the Journal of the Bengal Asiatic Society, contains an account of a shower of stones which fell at Soojoulee on the 7th of March 1853. It is as follows:—

"I was informed by a native on the 7th of March 1853, that a shower of stones had fallen in the neighbourhood of Soojoulee on the preceding day at noon. I immediately sent a person to make enquiry as to the truth of what had been related to me. The person sent, returned the following morning and brought me three meteoric stones. He stated that many more had fallen, and had been picked up by other parties. In the meantime I met three of the officers of the Irregular Cavalry at Soojoulee, who informed me that they had all remarked, and been much struck with the peculiar rumbling noise they had heard on the previous day at noon; it could not be mistaken for thunder, the sound being, as stated by them, totally different. An Italian Priest stationed at Bettiah, seventeen miles west of Soojoulee, remarked the same kind of noise at the same hour, and he mentioned to me that all the natives around him were much alarmed,

and the head 'gooroo' of the Bettiah Raja sent to ask him if he could explain what such strange sounds in the heavens portended. Another Italian missionary priest stationed six miles Nort-West of Bettiah, made the same remarks. The priest at Bettiah compared the noise to that of a heavy cart or waggon passing over a platform. The sounds were audible for forty seconds, the sky was cloudless and the sun shining brightly at the time. The wind was west and cool, the weather for some days previous to the 6th March was particularly cool. The Thermometer stood on the 4th, 5th and 9th at 44o. at day-light. The number of meteoric stones which I know to have been picked up within a circle of a mile, amounts to at least thirty. The weight varied from ½ lb. to 4 lbs. and one weighed as much as 14½ lbs. The shape in every instance was less or more pyramidal."

Considering the great frequency with which Meteoric stones fall to the ground, in individual masses or in showers, it is singular how seldom fatal accidents are occasioned by them; a fragment a pound weight, descending from an unknown height in the atmosphere, would have split the thickest skull without trouble—a mass of fourteen pound weight would have penetrated a stone wall like a cannon shot.

FALL OF METEORIC STONES.—On Saturday the 28th of February last two large Meteoric Stones having fallen with considerable velocity so as to bury themselves into the earth near the village of Parnallee in the district of Madura, the Rev. Mr. H. S. Taylor, Principal of the American Mission there, having been made acquainted with the fact, proceeded himself to examine the spot, and at the request of the villagers reported the circumstance of their fall to the Collector. The following are Extracts from his letters upon the subject:—

"Near the Village of Parnallee in this Talook two Meteoric Stones have fallen. I have been on to the ground and seen the places where they fell, and the exact impression made in the earth where they lay. As no rain has fallen since, I was able to see that there was no mistake about it. The noise made as they came through the air, made a deep impression on the minds of the people in that region, and was heard, I find from reports, along the sea shore up to Teruchooly. They fell about three miles apart from each other. The smaller one weighs about 37 pounds, and sunk in the earth when it fell two feet and eight inches. The larger one is from three to four times as large, and sunk in the earth two feet and four inches. It struck the earth flatwise. The smaller one fell about perpendicularly. The larger fell (coming from the North a little to the West) making an angle with a perpendicular line, of about fifteen degrees. Persons were standing near each place when they fell. Many worshipped them. The villagers gave them up to me on condition that I should inform you, and save them from trouble made (or rather which they feared some officials might make). I do not make this statement officially, but I am ready, if you desire it, to make an official statement on the subject. In writing this I have fulfilled my promise to the people there.

* * * * * In respect to Mr. Murray's request through you, I would state that I gave a somewhat minute account of their fall, &c. to Dr. Colebrooke with liberty to publish should he think best in the *Athenæum*.* If he has done so, this may not be needed. I will however give a few particulars.

They fell on the 28th of February, Saturday, at about noon, a little South

* TO THE EDITOR OF THE ATHENÆUM.

SIR,—Some of your readers may be interested to learn that two Meteoric stones fell in the village of Parnallee in the district and north of Madura on the last February and at noon. The fall was preceded by a report like that of a heavy piece of artillery, and the vibration of the ground that was much heavier, and the stones were projected with such force that though one weighed 37 pounds and the other four times as large, they were neither of them found at a greater distance than three miles from the place where they fell. Many worshipped them. The villagers gave them up to me on condition that I should inform you, and save them from trouble made (or rather which they feared some officials might make). I do not make this statement officially, but I am ready, if you desire it, to make an official statement on the subject. In writing this I have fulfilled my promise to the people there.

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East of the Village of Parnallee, Latitude north, according to the Government Map, 9o 14', Longitude 78o 21' East.

The largest one fell a few seconds before the smaller one, and from two to three miles North of it. As was manifest from the hole it made in the ground when it fell it came from a direction some ten degrees West of North, making an angle of about 15 or 20 degrees with a line perpendicular to the earth's surface. It struck the earth, (or at least lay in the bottom of the hole made by it) flatwise, on the side that is most convex. The most round or convex side of the smaller stone also was downward, this being the position they would naturally assume as they passed with great velocity, through the resisting atmosphere, an idea which did not occur to me till now. I had before simply noted the fact The larger stone sank into the earth when it fell two feet and five inches in a perpendicular direction. The smaller one about two feet and eight inches. The smaller one fell also about perpendicularly. The smaller does not appear in any respect like a fragment of the larger one. The specific gravity of the smaller one when it fell was about 3.3, water being the standard of unity. I observed that the specific gravity was increased after exposure to a shower, or rather that of the smaller one was. I did not try that of the larger. The crack on the convex side of the larger one I did not perceive at all till it had been wet, and then at first it was but just perceptible. Afterwards it gradually opened, I suppose owing to the oxidation of the native iron it contains, perhaps however to other causes. The stone had not been wet till they came into my hands April 21st. They each of them fell in cultivated fields, one of which had been harvested. The straw in the other was still standing.

The *noise* seems to have been terrific to the Natives, causing those near to crouch from fear. It came like two claps of thunder, as they fell one after the other, and continuing for some time, but gradually growing less loud. As they fell through the whole depth of our atmosphere this would naturally be the case. The noise appears to have been heard at Tuticorin forty miles distant. At this place, sixteen miles North, it excited considerable interest among those abroad at the time. The noise must have been great, occasioned by their great velocity. Taking their specific gravity into the account, say 3.3, their size being about that of large cannon balls, some allowance also being made for their irregular shape, from the depth they penetrated the soil, which was of about common hardness, those who have observed the power of projectiles in such cases, will be able to calculate, approximately, what that velocity was.

Of the excitement among the Natives I suppose I need not speak. I visited the place because of the rumours that were flying abroad, making it evident to my mind that some thing peculiar had there transpired. First I saw the holes from which, in the cultivated fields they had been freshly taken, no rain having subsequently fallen, and saw at the bottom the *hardly compressed*, and exact impression left by them as they were taken up, and then as soon as I saw the stones, I knew instantly they were the identical ones which had been taken up from those places. As I was more or less known in that region, and there is no gentleman whatever any where near, the rural people, utterly ignorant of the cause, came in great numbers to state the facts and ask some explanation. Some of them supposed they were gods that had fallen, some that they had been shot from cannon on ships at Tuticorin, and some that a Brahmin had brought them from the sea by his Munterums. Some rejected all these theories, but no one could tell or feel satisfied as to how these things could be. By simply striking my staff through the air I could explain to them the noise; and by tying a stone to a string and swinging it, I could make them understand the centrifugal and centripetal forces, and how that from some disturbance in these forces,

of these bodies was heard distinctly at Tuticorin 40 miles off and in all the surrounding villages.

The subject appears to me an interesting one for scientific enquiries, and this is my chief reason for requesting you to have the goodness to cause its insertion in the columns of you paper.

I am, Sir,
Your obedient servant,
J. COLEBROOKE,
Zillah Surgeon, Madura,

MADURA, *9th April* 1857.—*Athenæum.*

stones moving about some centre like the Moon about the Earth, might fall. The explanations gave them relief. They put confidence in me, and gave me the stones at my request, that I might save them from the trouble of any official investigation, and put them into some Museum or Scientific Institution.

P. S.—I forgot to say that there was nothing peculiar in the state of the atmosphere. It was a clear day. When the stone is sent on to Madras, if any scientific Gentleman makes an analysis of it, for the Museum, please be so good as to ask a copy of it for me.

METEORITES IN THE DESERT.—A piece of meteoric iron was some weeks since picked up in the desert at the last horsing station, about ten miles from Suez by Dr. Buist. It weighs thirty ounces avoirdupois, and is of an irregularly spherical form, something like an illformed cannon shot. A characteristic which pointed out its meteoric origin was its honey-combing all over the surface, indicating its having been in a molten state without having been in a mould. It was found too hard to cut with a file or saw, or to turn; and being split in two with a chisel, it was found of a lightish grey colour, full of small air-holes, and beautifully radiated from the centre outwards, with a crystalline texture like that of antimony. It still remains to be examined chimically. The finder was on the outlook for Egyptian jaspers, and seeing one darker than the rest, picked it up, and to his astonishment found it a meteorite. As it is considerably less in size than the majority of those with which we are familiar, it is not improbable that other fragments may exist in the neighbourhood; and future passengers, curious in such things, might do well to be on the look-out for them. The railway will three months hence cause the station-houses to be forgotten. Unless for the accident of fragments, the chances are myriads against one, against a rarity of this kind being found; and a wild tract strewed thick with stones like the desert, may be searched for centuries without any thing of this kind again occurring.—*Bombay Times, Oct.* 10 1857.

APPENDIX C.

EARTHQUAKES.

EARTHQUAKE IN TRAVENCORE.—SIR,—Perhaps the following account of the Earthquake observed in Travencore on the morning of Monday the 11th instant may interest some of your readers.

The assistant in the Trevandrum observatory having the watch on the morning referred to was entering an observation when he heard a low rumbling sound which he thought at first was distant thunder towards the North-East; in about three seconds the rafters of the building began to creak, the windows to rattle and a mirror resting on the table to shake: he immediately looked at the clock and found the time 5h 53m. 30s. which, allowing for the known clock error, would give the mean Trevandrum time of the commencement of the sound 5h. 51m. 25s. He then went out to look towards the North-East and immediately thereafter the sound ceased with a louder "bom;" on looking again at the clock the time by it was 5h. 54m. and he estimated the duration of noise and shock at nearly twenty seconds. He now examined the magnetical instruments, but could perceive neither vibration nor change of mean position. It is not impossible however that the magnets might have had swinging or dancing motions without being remarked by the observer, as vibrations round a verticle axis only are noticed. An examination by myself since, of the observations made before and after the shock, confirms the fact of the steadiness of all the magnets, neither did I find any thing remarkable in the state of the atmosphere. The velocity of the wind from the North-west was rarely as usual at the same hour; the sky was nine-tenths clouded, the clouds moving from North-west; the temperature of the air was nearly 73°. the maximum temperature of the day being nearly 78°.

A Lady living near the observatory was awoke by a low rumbling, puffing noise, which terminated by a stifled explosion, as if under ground, she saw the

foot of the bed moving slightly from side to side (north and south) and heard the windows rattle. The sound seemed to her to precede the shaking by a few seconds, but she did not conceive that the whole lasted more than from five to ten seconds. The air appeared hazy to her and to several other persons. The atmosphere felt close and disagreeable during the day.

Lieut. Col. Faunce, living about three-quarters of a mile west of the observatory, has informed me, that the noise and shock appeared to him to come from the south east and to proceed in a north-westerly direction: the noise seemed in or on the surface of the ground and the noise and shock lasted at least six or seven seconds. The shock was rather strong, his right leg was swayed from right to left (i. e. east to west) while he was sitting facing the north and his body felt the movement. Col. Faunce also thinks that the sound preceded the shock. The windows rattled considerably. He likened the noise to that of a steam carriage; a rumbling sound terminating louder than it commenced.

Dr. Sperschneider, three quarters of a mile north west of the observatory, also felt the shock. The noise he says began a few seconds before the earthquake and lasted a few seconds after it. It appeared to Dr. Sperschneider to go off in a westerly or northwesterly direction; the windows and roof of his house trembled.

Dr. Waring, about a mile and half north of the observatory, heard and felt the earthquake though apparently not so markedly as by the others. I am told that about the same distance south, southeast of the observatory the shock was very distant; while within the Fort about two miles south of the observatory the earthquake was not perceived at all. It should be noted that about the Fort decomposed granitic rocks are covered by a thick stratum of sand, while all the other stations are immediately on laterite rock.

The shock it seems was felt at Quilon "about six o'clock" and Mr. Liddell at Charlie's Hope near the road between Quilon and Courtallum says "we had a smart shock of an earthquake about ten minutes before six on Monday morning."

I was on the summit of our highest mountains, the Agusteer Mally (about 30 miles W. N. W. of Trevandrum) on Monday the 11th but did not perceive any shock. I noted that the Tinnevelley country and the mountains to the north appeared much clearer that morning than usual.

The testimony on the whole seems to indicate a southerly and easterly point as the direction of the origin, all agree that the sound was heard before the shock was perceived. It is quite possible that the shock may have been propagated from Tinnevelly below the ghats and not have been very sensible at their summits. It would be of importance for the purpose of determining the origin, the velocities and the direction of transmission of the shock to have the accurate time it was perceived at some localities considerably distant from Trevandrum.

I have the honor to be, Sir,
Yours obediently,
JOHN ALLAN BROWN.

Trevandrum Observatory
16th August 1856.

P. S. Where the earthquake has been observed it will be desirable to mention by what means the error of the timepiece has been obtained.—*Athenæum, August* 23.

SECOND SHOCK OF EARTHQUAKE IN TRAVENCORE.—SIR,—I took the liberty a few days ago of forwarding to you a notice of an earthquake felt in Travancore on the 11th Instant, allow me to add to that communication that I have found since that the shock was neither perceived at Nagercoil (40 miles S. E. by E. of Travendrum) nor at Cochin (120 miles N. W. by N.) but I understand it was felt at Cottyam (90 miles N. E.) by several persons; and Dr. Barker estimates the time of the shock there at 5h 50m A. M. (verified to some degree by the sunrise) this time agrees really with that of the shock at Trevandrum. At Quilon Mr. D'Albedhyll informs me that two ladies give 20 minutes before 6 as the time of the shock. On the best consideration of all the facts as yet received by me I

am inclined to consider a west north westerly direction from Trevandrum as that of the origin of the shock and perhaps towards the Laccadive islands.

On the 25th August about 4 hours 25 minutes P. M. while lying on a cot reading in an upper room I felt the cot shaking rather violently. I immediately looked at the bed posts, these, and the tester frame seemed to vibrate irregularly and sharply from east to west. On going to the magnetic observatory I found the time of the shock to have been almost exactly 4 hours 25 minutes, 10 seconds. I observed the magnets dancing up and down in short jerks, and a brass weight hanging in a closed box was observed, by means of a telescope, to dance perceptibly 15 minutes after the shock. I could not observe any swag or side motion, but I concluded from the vibration of a hanging cord, seen in a room below me by another person, from the motion of the bed posts, and from the wetted sides of a glass vessel containing water, that the shock had been propagated in the direction between W. N. W. and E. S. E the shock was accompanied by a low trembling sound. This second shock was observed also at Quilon by Mr. D'Albedhyll and others about 4h. 16 minutes. If the clocks there can be trusted this, as in the case of the first shock, is about 10 minutes before the time at Trevandrum.

General Cullen informs me that a shock was felt in Travencore in February 1823, 15th Sept. 1841 and 23rd November 1849.

I shall feel obliged if any person has observed the time or direction of either of the shocks of the present month by the communication of the facts to me. I have the honour to be, Sir, yours faithfully,

JOHN ALLEN BROWN.

Trevandrum, 25th August 1856.—*Athenæum.*

P. S.—The second shock is said to have been stronger than the first. The first shock was observed at Quilon by few persons ; the second was observed by many Europeans and Natives. No native at Trevandrum appears to have observed either shock excepting those in the watch at the Observatory. J. A. B.—*Ibid.*

A THIRD EARTHQUAKE SHOCK IN TRAVANCORE.—Sir,—The shocks of earthquake are reaching us so frequently that they will cease to be interesting as news, and the proper place to notice them in detail will be in the pages of some scientific periodical.

Another shock was felt here 45m. 0s. afternoon of today (1st September). The effects of the shock on the magnetical instruments were even more remarkable than on the last occasion ; and the ball of a pendulum 17 feet long moved through a space of about 4 inches in the direction N. W. by N. and S. E. by S. ; I believe from the former to the latter.

In my attempts to obtain information on the last two shocks, I have heard (from Dr. Colebrook of Madura) of a remarkable shock experienced the 17th of March last, near midnight, about 30 to 40 miles east of Madura, the noise seeming to travel from west to east. An examination of the observations of the magnetical instrument in observatories on Agustier Mullay and here, shows that the shock was felt markedly by both places.

Any communications on Earthquake shocks felt in Southern India addressed to me would much oblige, Sir, yours very obediently,

JOHN ALLEN BROWN.

Trevandrum, 1st September 1856.—*Madras Athenæum.*

LEVANT EARTHQUAKE 12TH OCTOBER 1856.—Early in the morning of Sunday, the 12th of October, the inhabitants of Alexandria and of Cairo were alarmed by the first faint heavings of an earthquake. Several slight shocks having been experienced, a tremendous roll preceded by the usual heavy rumbling noise, as if a train of waggons was passing, was felt almost exactly at three o'clock. The railway clock at Alexandria stopped five minutes to three, that of Cairo twelve minutes afterwards. The people rushed to the streets everywhere, and in ten minutes' time there was a vast concourse in the greatest square at Alexandria, of females as well as males, in a state of extreme dishabille. A few old walls and buildings fell, and many houses were slightly injured; the doors slammed, and lamps swung everywhere, but only two lives are understood to have been lost. Near Cairo a minaret had fallen ; and a Madras officer and his lady, standing on the balcony at Shepherd's Hotel, had the narrowest possi-

ble escape, a mass of building from above having tumbled down, and passed within a foot of them. The earthquake was felt at Suez where a violent Hail storm occurred at the time—a thing singularly rare in Egypt. About the same date—we cannot quite make out if it was on the same day or not—slight shocks of earthquake had been felt at Aden. It may be remembered that at this time, we had for nearly a week cloudy threatening weather, with much lightning and some thunder.—*Bombay Times Novr.* 1856.

"On Sunday morning last, at precisely eleven minutes before two, the Islands of Malta and Gozo were visited by shocks of an earthquake, so violent in their nature and so long in their duration, that the oldest inhabitants do not remember ever to have experienced anything so severe. The first shock made itself perceptible by a tremulous motion similar to that caused by the passing of a heavy gun-carriage, a thousand times repeated, accompanied by a rumbling noise, as it were, of distant thunder, which rapidly increased in violence, until every building shook and trembled. Scarcely a minute had elapsed when a second and still more violent shock, accompanied by a louder noise, occurred. The alarm occasioned was general throughout town and country. Men, women, and children of all classes in society, suddenly aroused from their slumbers, issued from every house, some in their night-dresses, others enveloped in a sheet or blanket, and others in the first articles of apparel they could hurriedly catch up; and the streets in a very short space of time became full of people, who had quitted their dwellings, fearing to be included in a general destruction. In some parts the two shocks, lasted apparently for rather more than two minutes, whilst in other localities and in some parts of Valletta, persons affirm that they occupied no less than from three to four minutes, and even upwards. In town almost every building, has been more or less injured, and the corner structures have particularly suffered, owing to their more exposed position. The steeple of Queen Adelaide's Church, from its height and tenuity was naturally an object likely to be most seriously affected by undulation; and in fact five or six of the courses or stones from the point of the spire have been so shaken, and as it were, wrenched, that probably they will have to be removed to be properly relaid. The stone cross and ball which crown the steeple are thrown out of their perpendicular, the former leaning to the westward, and the latter to the eastward whilst the pomegranate which formed the nob for the vase on Ponsonby's Monument has been thrown to the ground. Of the Roman Catholic Churches in Valletta, that of St. Dominico appears to have suffered most and many buildings are rent in a manner, as render immediate repairs necessary. From all we can learn the convulsion was most severely felt along the north front of the Island, the forts on that coast having been much shaken, whilst those on the south sea-board experienced the shocks in a much slighter degree, and are, we are informed, not the least damaged. At Floriana and in each of the Three Cities, as well as in the harbour, the shocks were felt with considerable vigour; and at Shenglea many of the buildings are injured. Persons on board ships in port describe the effect of the earthquake, as felt by them, as of letting go the ship's boats from the davits only much stronger. The sea, it is said, receded two feet and a half; and at a quarter to four the same morning rushed back, lashing the rocks outside the port with considerable violence. The night had been without a breath of air, with a sultry sensation, the sea perfectly calm, and the moon shining in a clear sky with a brightness that seemed to transform night into day, it being within twenty-one hours of full moon. At Cittah Vecchia, in the interior of the Island, the shocks must have made themselves felt severely; all the churches, monasteries, nunneries and hospitals, the church of St. Augustine excepted, having sustained greater or less damage. The dome of the Cathedral is rent, so as to admit the light, and the belfry is very much shaken. The expenses necessary to repair the injuries done to the Cathedral alone are estimated at several thousands of pounds. A small room near Citta Vecchia, built of stones without mortar, fell in altogether. From all parts of the country we hear of buildings having been more or less damaged; amongst others the new church at Musta, which is still unfinished, and the new church at Sliemo, as also the church at Naxiar. At Casal Siggieui the belfry and a part of the roof of a small church, called *Tal Ghalia* fell in; the dome of the parochial church was also

seriously affected. Happily, we have heard of no loss of life, although at first a most painful report was spread that Fort Chambrary, a very old building in Gozo, had fallen in, burying in its ruins three hundred of the English soldiers quartered there. Subsequent accounts proved this to be a fabrication; and the only damage stated to be sustained in Gozo, besides a number of buildings being slightly injured, is the falling in of a portion of one of the telegraph owers. In Malta, as we believe is the case in other Roman Catholic countries, it is usual to ring the bells of the churches on occasions of imminent danger; and on Sunday soon after the shock had ceased, a burst of tintinabular sounds was everywhere to be heard. On the same day a *Te Deum*, thanksgiving, was chaunted in all the churches, to which was added the ceremony of the exposition of the Holy Sacrament; and sermons were delivered to crowded congregations. A common persuasion exists amongst the people of Malta, that this sorts of phenomenon is generally repeated at the expiration of twenty-four hours which induced many to quit their houses, and remain in the streets and field until after two o'clock in the morning of Monday, when they very philosophically retired to rest, considering all danger at end."

Alexandria is in longitude 30° 10' Valletta in 14° 30', in both cases omitting seconds. The difference of longitude in measure is therefore 16° 40'. The earth sweeping round through space at the rate of fifteen degrees an hour of time, travels one degree in four minutes, and 3 o'clock A. M. at Alexandria, is therefore 1. 53 at Malta nearly. The first shock was felt at Valetta at 1. 49, the second a minute or so afterwards. If the two clocks could be relied upon, it would show that they occurred almost simultaneously at two places a thousand miles apart.—*Bombay Times.*

EARTHQUAKE.—We have been courteously favoured by the Fort Department with the following depositions—showing that the *Earthquake* which was felt in Malta, on last Sunday morning, has also been felt in many parts of the Mediterranean.—*Malta Mail, Oct.* 18.

Copy of a deposition made by the Master of the Neapolitan Paranzello S *Maria di Porto Salvo* who arrived at the Port of Malta on the 16th October 1856 at 11.45 P. M.

"On Sunday last at about 2 A. M. a very strong shock of an earthquake was felt at Pozzallo, which caused great damage to the churches of the town, but not so much to other buildings. No lives lost."

True Copy.

A. FENECH.
Acting Superintendent of the Ports.—*Ibid.*

Copy of deposition made by William Froud, Master of the Steam Vessel *Empress*, on the 16th Instant.

Sunday, 12th October, 1856.

"Between 2 and 3 A. M. making towards Canea, Isle of Candia, a very heavy cross sea running laid the Ship's head to Eastward, and after laying a short time felt a strong shock of which I took no notice supposing it to be the sea breaking on the bow.

At day light found the Sea a little better, steamed on for Suda Bay, I took a horse and went over to see the French Consul at Canea upon some Government business when I heard that there had been a strong earthquake between 2 and 3 o'clock in the morning, several houses being split, minarets fallen down, and some houses altogether fallen to the ground; the loss of life was supposed to be 5 or 6 people, but a great number of wounded. In a village on the sea shore a mill fallen down had crushed 5 people, and at Suda we saw a salt store with stone walls knocked to the ground.

The above is correct, and all I can remember as I took no particular account of it at the time.

(Signed) WILLIAM FROUD,
Master of S.S. *Empress* French Transport Service.

True Copy,

F. V. INGLOTT,
Assistant Superintendent of the Ports

17th October, 1856.

Copy of deposition made by Thomas A. Orfeur, Master of the British Screw Steamer *Arcadia*, on the 17th instant.

"At 11. 30. on Saturday, the 11th, a slight shock of an Earthquake was felt on Smyrna which lasted about 1½ minutes; and at Syra at 2 A. M. on Sunday morning, rather sharp, lasted 40 seconds. No damage received in either places, a very strong N. E. wind blowing at the time."

(Signed) THOMAS A. ORFEUR, Master

True Copy

17th October, 1856. F. V. INGLOTT

Assistant Superintendent of the Ports.

The Master of the Neapolitan Schooner *Cassiopea*, who arrived from Syracuse the 17th October 1856, reports :

"That during the night, between the 11th and 12th instant, at about 1.45 A. M. a rather strong shock of an Earthquake was felt at Syracuse but caused hardly any damage to the building.

It was however reported that the Town Gran Michele in the Valley of Palermo has suffered great injury, with the loss of few lives : Mount Ætna has been for the last two months remarkably quiet, but after the Earthquake occurred, it commenced to emit volumes on smoke."—*Bombay Times*.

True Copy

A. FENECH,

Acting Superintendent of the Ports.

EARTHQUAKE.—By the arrival of the Steamer *Wye* from Corfu, we learn that the *earthquake* was felt very strongly there, at about the same time, and with the same motion, as in Malta. It caused the greatest alarm amongst the inhabitants ; but little damage to property. The oldest residents in Corfu state that it is the strongest they have ever felt ; and shocks of earthquake are rather frequent in the Ionian Islands. It is now evident, by the information received from various parts, that the shock has been felt almost throughout the Mediterranean particularly in the East. The *Impartial* of the 16th instant, states that on Sunday, at ¼ to 3 o'clock in the morning, an earthquake was felt at Smyrna. It was not one of the usual shocks, but lasted about a minute with strong undulatory motion from north to south. That paper contains very deplorable news from the Island of Rhodes, where it appears the shocks were very violent. More than fifty houses are in ruins, besides many having been much damaged. A mosque and part of the noted tower of Rhodes are also destroyed. The loss of life is not yet known. All the islands adjacent have suffered more or less from the same earthquake. In Sicily it has been felt slightly, but created the utmost consternation amongst the people. The *Mediterraneo* says that an expenditure exceeding £50,000 will be required to repair the damage occasioned by the recent shocks in Malta. The shocks were also experienced at Cairo, causing the destruction of many houses and mosques. The last destructive earthquake felt at Smyrna was in the year 1778. And at Rhodes and Macri in March 1851, when a mountain fell in at the latter place, crushing a village, and destroying 600 persons At the time of the great earthquake at Lisbon in November 1753, a singular phenomenon happened in the hot-well at Bristol : the water suddenly became as red as blood, and so very turbid that it could not be drank. The water also, of a common well, which had been remarkably clear, at once turned as black as ink, and continued unfit for use nearly a fortnight. The tide, likewise, in the river Avon flowed back, contrary to its natural course ; and various other effects of some unknown convulsion in the bowels of the earth, were perceived in different places. But all conjecture as to the cause of these extraordinary circumstances was vain, till the news arrived of the earthquake at Lisbon having happened on the same day, which gave a satisfactory solution to the several phenomena.—*Bombay Times, October* 24.

EARTHQUAKES AND STORMS 1857 —In publishing the following letter we may state that the Earthquake was felt very violently at the Cape—that Vesuvius

was in a state of eruption—and that Messina was visited by a violent storm of hail the size of pigeon's eggs. We may probably hear of Volcanic disturbance in South America.

Galle Sept. 29, 1857.—At 2. 20 a. m. on the 14th of August last we had an earthquake in Ceylon, and you remarked in connection with it that the seasons were out of joint at Madras, Bombay, &c. Everybody seemed to expect that the China steamer would bring the news of some terrible catastrophe in the Indian Archipelago ; but all seems to have been quiet in that quarter. I think two of your correspondents stated that the shocks proceeded *from West to East* : and the Home News which arrived yesterday mentions (to say the least) a very remarkable coincidence under the head of Casualties. "One of the most vio- "lent storms that has visited this country for many years swept over the metro- "polis and nearly every part of England on the evening and night of the 13th of August." The difference between Galle and Greenwich time (80 degrees of longitude) is 5 h. 20 m. so that the earthquake occurred here at the very time when the storm was raging in England ! I mention the fact, as it might other- wise escape the notice of some who are deeply interested in meteorological and magnetic phenomena.—*Columbo Observer, Oct.* 1857.

EARTHQUAKE, CAPE OF GOOD HOPE 12TH APRIL 1857.—On the evening of Friday, the 14th August, at thirty minutes past 11 o'clock, an earthquake of considerable violence was heard and felt over the Cape Peninsula, from Cape Town and Simon's Town, and as inland as Stellenbosch and the Paarl, an area of about 4 0 0 square miles. There was nothing peculiar observed in the atmosphere before or after the sound and motion. The air was still and the sky cloudless and clear. The temperature was such as we generally experience at this season of the year.

The duration of the shock is variously estimated, and may have varied at different places—the sound from 15 to 70 seconds, the agitation of the ground from 10 to 30 seconds. This may be accounted for in part, also, by the differ- ent estimates of time which people make in different states of feeling, especially when every observer is taken by surprise, some suddenly roused from sleep, and nearly all in the dark. About the centre of Table Valley, between the Lion's Hill and Table Mountain, the sound, we think, continued about *30* se- conds, but it is possible that part of it was an echo from the neighbouring heights. For about five seconds we heard the sound as on the spot, under and all around, exactly as if a strong whirlwind raged against a house, and rushed through open doors. It then ceased in the north-east, and was heard as it soft ened towards the south-west, in which direction it seemed to have travelled. In this case much of the noise is no doubt due to the vibration of the walls, floor, and roof of the house. In the open air it was more distinctly perceived to be from underground.

The movement was for 4 or 5 seconds rather sharp. The *force* appeared to us to be acting both vertically and horizontally, at the same time, struggling up- wards and quivering. No two things are exactly alike, and happily few of us can compare one earthquake with another from our own experience. But the thing which resembles it a good deal is the vibration of a ship felt on the deck, when a heavy cross wave has struck her between the main-mast and the bow. It does not appear that any damage to buildings or displacement of solid bodies, occurred in this case.

We have heard of only two previous earthquakes well pronounced at the Cape within the present century, one in 1809, when three distinct shocks were felt, much more violent than that of Friday night, the other in 1834, much slighter. They are less frequent in Africa than in the other continents. Africa is also least subject to volcanic action.

The causes of these phenomena have not yet been disclosed to human curi- osity. We are still ignorant of the nature of the power which can thus, as it were, in a moment of time, shake the mountains and plains and the valleys of the ocean over many thousands of miles. In 1822 the Chilian Coast was shaken over an area of 100,0 0 square miles, and the whole region of the Andes and a line far out to sea was permanently raised several feet above their for- mer level. It is difficult to admit that a central or limited force could move so enormous a weight. Yet to what other imaginable source can it be descrih

ed? Its action differs in many respects from that of gravitation, electricity, galvanism, or magnetism, mighty powers which everywhere control the material universe. To each of these, with more or less plausibility, as well as to elastic fluids generated by heat, or arising from chemical action far down in the depths of planet, have ingenious minds endeavoured to trace these vibrations and heavings of the surface. But insuperable difficulties beset every hypothetical explanation, and it is not absurd to suppose that there is yet another Power in nature awaiting the genius of another Newton.

The line of discovery is through observation, as we cannot make experimental earthquakes. The descriptions most to be depended upon, are found in the works of Humboldt, Lyell, and Mr. C. Darwin, and the authorities quoted by them, amongst whom Mr. Caldcleugh is distinguished, and we give below his observations on the great Chilian movement, the most remarkable that has been recorded in modern times. In this instance the line of coast was permanently *raised*. In other cases a permanent *sinking* has accompanied the action of this tremendous power. At Lisbon, in 1755, the new quay disappeared, and its place was occupied by whater 100 fathems or 600 feet in depth. Partial risings or sinkings have often occurred in volcanic regions, and may in many instances *sinking*, be reasonably traced to the elavations and discharges of material from volcanoes thus destroying the balance of portions of the earth's crust. But as a general inference drawn from all recorded earthquakes and volcanic eruptions, no direct connection can be affirmed to exist between them. Indeed volcanic action appears to be comparatively local and superficial, if we admit that any circumscribed force is the cause of these vast convulsions of the solid framework of the earth.

In the different accounts of the movement on Friday night there is discrepancy, but it does not follow that any of them are incorrect. The observers were placed many miles apart, and both the noise and the tremor from the character of the rocks may have been different both in apparent direction and intensity, as well as in duration. To one standing near Government House, the sound heard before the motion, seemed to come from Table Mountain, or the S. by West, and to pass over the Bay in the direction of Blueberg. To others its course appeared to be directly or nearly opposite. The probability is that there was a mixture of crossing both of sounds and movements, and the more distant sounds may have been mistaken for the dying away of such as were nearer, and therefore louder. It is not ascertained that earthquakes are *progressive*. The force may be acting in many directions from more centres than one: or, it may be diffused acting on each particle of matter at or nearly at the same instant of time. The greatest of all *known* powers act in this manner—gravitation, electricity, magnetism. The first is constant. The second is variable and cumulative. The last also exhibits *storms* and frequent alternations of relaxation and intensity. The power that shakes the solid and possibly the liquid masses of the earth, may also have its *fits of transmission*, playing with the rocks as its brother plays with clouds, and columns of air.

Though volcanic mountains are often shaken previous to eruptions, we have said that no ascertained communion exists between volcanoes and earthquakes generally. Neither has any accordance been observed between earthquakes and the temperature, weight, moisture, or electric state of the atmosphere. They have occurred in every condition of the atmosphere, at all seasons of the year, and at all conjunctions of the sun, moon, and planets. No constant phenomena either precedes or follows them. They dwell apart, terrible to us poor surface-holding creatures, unaccounted for and unaccountable, and dreaded most from the mystery that envelopes them. Compared with the Powers that command the planets and the stars, they are as bubbles on the wave. These powers are ever active around us and within us, but familiarity deprives us of the sense of grandeur. The trembling of a small portion of earth no more makes us more sensible of our dependence on the Possessor of all Power, than the much more rapid motion of the whole planet by day and night, and even in its annual circuit of some 300,000,000 of miles. How important it is to be on good terms at all times with that Power whose servants can in a moment level our habitations in dust, as His own hand could crush the universe?

MALTA—LIGHTNING.—The electric fluid at noon on Friday occasioned two fatal accidents to human life in the country districts, one in the limits of Casal Lia, where it struck a farm-house, killing the wife of a countryman, named Giovanna Borg, aged 40, and one of three cows, which were in a stable adjoining the building; and the other at Casal Siggleni, Strada SanGiacomo, where it entered a window of a house, knocking down the outside wall, and killing a poor child, aged five years, named Luigia Vassallo, and so severely injuring her sister Vincenza, aged 12, as to cause her death on the following morning. The father, who, it is said, was in the house at the time, escaped unhurt. The steeple of Queen Adelaide's Church in Valletta was struck by lightning, and the large stone cross seven feet in height, which had been thrown out of its prependicular by the earthquake on the Sunday previous, fell, alighting on the gallery which encircles the base of the spire. The massive stone ball, upon which the cross rested, remains suspended some feet below the top of the spire, merely by the lightening conductor to which it is attached, and which appears to support it in a very critical and uncertain manner. Preparations are being made by the Public Works' Department, to erect a scaffolding to remove the impending danger. The operation will require great care, and is by no means an enviable duty. The inhabitants residing in the vicinity have in the meanwhile temporarily removed their abode to places of greater security. Early on Saturday morning, upon the wind changing to the South-West, our Island was again visited by a fearful thunder-storm, more appalling than that on the previous day, accompanied by continued torrents of rain, to such a degree as to lay in ruins in all parts of the country many of the loosely-built walls, enclosing gardens and fields; and in some instances, we hear, to wash away orange and other trees. Houses, which were severely shaken by the earthquake, were completely inundated with water and a considerable amount of property has been damaged by the wet. The storm lasted until the afternoon, when the wind changing to the North-East the weather cleared up. On Sunday and Monday mornings the wind again went round to the South-West, bringing with it dark clouds surcharged with electric fluid; which breaking over the Island, made the air resound with loud and reiterated detonations. At about half past one this morning another fearful thunder-storm burst over the Island, and continued until four o'clock, a. m. The bells were rung incessantly in all the churches in town and country until a quarter past three, when the storm began to abate. Happily we have no further accidents to report.—*Bombay Times, October 21.*

MALTA.—TERRIFIC HAILSTORM AT MESSINA.—A private letter from Messina, dated 18th August, says:—"Yesterday afternoon this neighbourhood was visited by a most terrific hailstorm from the North West. In the town some of the stones that fell were as large as a man's fist; but in the country they were much larger. A person whose word I believe has assured me that he weighed some of two rotoli each. In Messina the tiles of the roofs were terribly smashed; and in the country considerable damage was done to the trees"—Another letter from Messina of the same date thus speaks of the phenomenon:—"Yesterday at 4. 30 p. m. we were visited by a most fearful hailstorm. The hailstones were as large as goodsized oranges, and some much larger. Fortunately it lasted only about four minutes; but, as it was, I really thought our last day was arrived. The damage to the tiles and glass of the houses and to the country is immense. *Times, August 25 1843.*

VOLCANIC ERUPTION IN THE MOLUCCAS 1843.—The Indian mail brings advices of one of those dreadful calamities for which the Moluccas are proverbial—an eruption of the volcano in the island known as the Great Sangir, a few degrees north of the equator:—

Between seven and eight o'clock on the evening of the 2d of March a sudden and altogether indescribable crashing noise was heard, which, indicating to the Sangirese an eruption of the volcano, filled them with consternation. Simultaneously with this the gushing lava stream downwards with irresistible force in different directions, bearing with it whatever it encountered on its destructive course, and causing the sea to boil wherever they came in contact. The hot springs open up and cast out a flood of boiling water which destroyed and carried away what the fire had spared. The sea, obedient to an unusual impulse, lashed the rocks with frightful violence, dashed upon the shore, and heaved itself with a wild haste against the land, as it strove to overmaster the

fire-stream. This frightful picture of destruction, the horror of which was increased by the shrieks of men and beasts, the wild roaring of the tempest and the crashing of thousands of trees torn up and carried away, was followed about an hour later by peals of thunder which shook the ground and deafened the ear. A black column of stones and ashes then shot up from the mountain to an immense height, and fell, illumined by the glare of the lava, like a shower of fire upon the surrounding country below, producing a darkness that, only now and then momentarily broken by the flashes of lightning, was so intense that people could not discern objects close at hand, and which completed their confusion and despair. Large stones were hurled through the air, crushing whatever they fell upon. Houses and crops which had not been destroyed by fire sank, and disappeared beneath the ashes and stones; and the hillstreams, stopped by these barriers, formed lakes, which, breaking over their banks, soon proved a new source of destruction. This lasted some hours. About midnight the raging elements sank to rest; but on the following day, about noon, they again resumed their work of destruction with renewed violence. In the meantime the fall of ashes continued without intermission, and was so thick on this day that the rays of the sun could not penetrate through it, and an appalling darkness prevailed. Scarcely recovered in some degree from their fright the inhabitants of this desolated part of Sangir were again disturbed by an eruption on the 17th of March, which destroyed many fields and a great number of trees on the Tabukan side. Since then the volcano has remained quiet, and the only symptom of its working has been the smoke rising up in all directions from cracks and fissures in the ground. On the other side of Kandhar, on the extreme north point of the island, the appearance of the devastation which has been caused is, if possible, even more frightful than what has taken place at Tartuna. For here, where formerly there were to be seen extensive fields bearing all kinds of crops, and thickly planted, and endless groves of cocoanuts, we now find nothing but lava, stone, and ashes. The liquid fire seems at this point to have flowed from the mountain with irresistible force and in prodigious quantity. Not only has this fearful flood as it were buried the whole district and all that was upon it, but after having caused this destruction over an extent of several miles, it was still powerful enough on reaching the shore to form two long tanjongs (capes) at places where the depth of water formerly consisted of many fathoms. A number of other districts and places have been some wholly destroyed, others greatly injured by the fire. The loss of life has been great. It is as follows in the undermentioned districts:—Tartuna, men, women, and children, 722; Kandhar, ditto, 45; Tabukan, ditto, 2,039; total, 2,803. The greater number met their death in the gardens. They fled in all directions, but were overtaken and swallowed up by the fatal fire-stream. Some tried to save themselves in the trees, but were either carried away with them or killed by the scorching heat. At Kalougar and Tariang the houses were filled with people, who were stopped in their flight by the lava streaming down on all sides and the streams of boiling water, and who met their death under the burning ashes and the tumbling houses. Many who had reached the shore and thought themselves safe became a prey to the waves.—*Standard July* 31 1856.

APPENDIX D.

BOTTLE LOGS.

A Bottle Log has just been received by the Geographical Society from the Dutch Government at Batavia, whose attention in these matters is deserving of the highest commendation. It was thrown overboard from the *Singapore* on her way from Bombay to Hongkong, at noon on the 23rd of October 1852,

and was picked up at Fannaballa on the west coast of Sumatra in April 1856. It had travelled from latitude 5 32 N. and longitude 82.57 E. to latitude 2. S. and longitude 100 E. or probably about eleven hundred miles in all. It was picked up on the shore by a native, and of the three years and a half betwixt the time of its being committed to the deep, and the date of its recovery, it is impossible to say how much was actually spent in the journey; and we can therefore make nothing of the actual velocity of the current. The direction is the same as that pursued by a Bottle Log thrown overboard at nearly the same point and previously returned by the Dutch Government. The whole Logs recovered by the Society clearly indicate amongst them a current travelling from opposite the middle of the Arabian Gulf nearly due East until it reaches the Straits of Malacca and turns to the South-ward, and crossing the Line rushes along by Borneo and Sumatra.

We have been favored with a bottle-log thrown from overboard the P. and O. Company's steamer *Singapore*, on her way from China to Bombay, at noon on the 27th of August 1856, and picked up at the south end of Junk Ceylon, where it had drifted on shore on the 17th October—by the Rojah Ket, Chief of that island. The point appears to be in lat. 8 N. and long. 98 E., so that it had drifted upwards of two hundred miles N. or nearly nine hundred E.,—or probably a thousand miles north-easterly in the course of fifty-one days at the outside,—for we do not know how long it may have been on shore. This gives a current of twenty miles a day, which had to all appearance been bending round considerably to the south of Ceylon, and was making north-easterly for the Straits of Malacca. It had drifted apparently through the Nicobars, and probably been blown ashore and off its proper course. Great care is requisite in ballasting bottle-logs, so as to avoid as much as possible this source of error; though we have no doubt that every precaution that could be thought of has been resorted to by the officers of the P. and O. Company, whose exertions in this and other departments of observation have been indefatigable, and crowned with eminent success;—

No.

This Bottle, with its enclosure, was thrown from on board the Ship "Singapore," on her way from China to Bombay, at noon on the 27th day of August 1853. Latitude 4° 37' N. Longitude 85° 37' E. Whoever picks it up is requested to forward the enclosure to the address of the Secretary of the Geographical Society, Bombay,—giving the name of the place where it was picked up, if found on shore,—or its position if found at sea, with any other particulars that may occur.

At Sea, August 27th, 1856.

(Signed) G. A. GRAINGER, Comdg. Ship "Singapore."

OBSERVATIONS.

Picked up at the South end of Junk Ceylon, on shore at 8 o'clock A. M., 17th day of October 1856, by

RCJAH KET, Rajah of Junk Ceylon.

No. 73.

This Bottle, with its enclosure, was thrown from on board the Ship Malta on her way from Bombay to Singaore, at noon on the 8th day of April, 1857. Lat. 35. 28 S. Long 21. 9 E. 19 E. 35 S Whoever picks it up is requested to forward the enclosure to the address of the SECRETARY OF THE GEOGRAPHICAL SOCIETY, BOMBAY,—giving the name of the place where it was picked up if found on shore,—or its position if found at sea with any other particulars that may occur.

(Signed) J. W. PURCHASE, Comdg. Ship.

AT SEA, 1857

OBSERVATIONS.

Picked up at Steen Roolfontein twenty miles E. of Port Beaufort o'clock, Twelfth day of May 1857.

Cape of Good Hope

In compliance with the request contained in the enclosure, I have the honour to inform you that a sealed Bottle containing the enclosure was found by me on the 12th of May sound and safe entangled in *Sea Weed* lying on the Beach forming part of the farm "*Steenkool Fontein*" situated between the *Duivenhok's* and *Kafferkuils Rivers*, twenty miles east of *Port Beaufort* a seaport in Southern Africa, Colony of Good Hope.

As this part of the Coast is but thinly inhabited, I cannot with certainty state, how long the Bottle might have been there, before I found it.

I have the honor to be

Sir,

Your most obedient Servant,

T. H. HOPMEYR.

Written at "Stenkool Font. 20th May, 1857.
District Rivendale Cape of Good Hope.

A Copy of another Bottle Log has been received by the Geographical Society thrown overboard on the 29th May last, from P. and O. Steamer *Singapore* in Latitude 7.31 N., and Longitude 76 52 E. It was picked up on the 17th of June on shore at Daladawatte in Cosgodde in the southern province of Ceylon. We are not able to make out the precise longitude of the locality here indicated—it is probably 81—the latitude about 5-10 N. It had thus travelled four degrees eight minutes east, and one degree fifty-one minutes south—or probably about four hundred miles in all in less than eighteen days—how much less it is impossible to say, as it is not certain that it was picked up immediately on being stranded. We are at all events safe in assuming, that it travelled at the rate of twenty-five miles a day at least, indicating a current of above a mile an hour. Of the twelve Bottle Logs thus recovered, five have been thrown overboard from the *Singapore*, three from the *Ganges*, one from the *Precursor*, one from the *Cadiz*, one from the *Erin*, and one from the *Semiramis*—a small portion certainly of the total committed to the deep, but furnishing not the less results of the utmost importance. We subjoin the letter received along with the Bottle Log, and trust this acknowledgment will meet the eyes of those for whom it is intended :—

"I beg to inform you, that a bottle and its enclosure (being a piece of paper in which any one who may happen to find them either in the sea or on the shore, is requested to forward the enclosure to your address) were found by me on the shore at Daladawatte in Cosgodde, in the Southern Province of this Island near to the 45th mile stone, on the morning of the 17th instant. Being ignorant of the English language, I showed the piece of paper above alluded to, to several parties residing in the village who were known to be acquainted with English, but not one of them being able to comprehend the meaning thereof, advised me to throw it away, as a useless and unmeaning thing. A day or two after, on the suggestion of one of my friends, I called upon Mr. C. P. A. de Silva, Mohandram of Cosgodde, and shewing him the enclosure and representing what the other persons had said, asked his opinion on the subject. He then upon suggested to me the propriety of immediately forwarding the enclosure of the bottle, as requested, to your address, which I then resolved to do, and but for him I would have had thrown it away as suggested by the parties above spoken of. This is the reason of the delay occasioned in addressing you on the subject. Any answer you may wish to communicate to me, is sure of being duly received by me, if sent to the address of the said Mohandram, who it was even thoughtfully made the mark of Gonemoony on this letter for me."

APPENDIX E.

ZOOLOGY.

We were favored a day or two since with a view of an animal rarely seen in Bombay however intimate one might get with the variety in the remote jungles. The animal we refer to is of the Ant-eater tribe, and was lately forwarded from Poona to Bombay by Mr. William Walker of the Railway, at whose bungalow at Chinchpoogly it was when we saw it. This specimen differs from others of the general species in several respects, although participating in many characteristics common to all. The snout of this Ant-eater nearly resembles that which is peculiar to the tribe, save that it is not so well guarded; but to make up for this deficiency, it has the power of rolling itself, snout and all, with ready ease into the form of a large ball, something after the manner of the common English hedgehog, but differing from this last in having no spines, but instead, a series of large sized laminations or plates, a sort of easy armour covering the whole of the upper surface of the body and tail, and extending marginally over both, in manner not unlike the projection of the turtle's shell. The plates or laminations are very flexible, and look not much dissimilar to the so called leaves of the English artichoke as it appears at table. The colour of the animal is a dun or dirty brown, and when rolled up it might be mistaken for an immense skittle ball, or Dutch cheese well plastered with mud, in which element it would seem to take much satisfaction, disporting itself over and over and wallowing in the mire. The tail is in shape, and after the fashion of the Beaver, but the chief peculiarity of this variety of Ant-eater, is the development of the flexible scales of horny leaves, which while allowing ease of motion, afford strong protection from its natural enemies. The length of this specimen is about three feet six inches from the tip of its snout to the end of its tail, and the weight is about twenty six pounds. If there was a proper place for its reception—something like a Zoological Garden—it might be preserved; but as it is it is much to be feared that the life of the animal in durance is not very insurable. The Ant-eater species is thus described in the third volume of "Cuvier's Animal Kingdom" page 261 under the head of "Pangolius" commonly called "Scaley Ant-eaters":—They "are destitute of teeth, have the tongue very sensitive, and subsist on ants and termites properly speaking, their body, their limbs, and their tail are covered with thick trenchant scales disposed like tiles, and which they raise in rolling themselves up into a ball when they defend themselves from an enemy. All their feet have five toes; they are found only in the ancient continent." This particular variety is described a little further on, as "the short tailed manis, three or four feet long with the tail less than the body," and it is said to be common to the East Indies.

APPENDIX F.

PHILOLOGY

Our Linguists would perform a piece of valuable service to the community if they would give us a popular Vocabulary of the current terms in use in Bombay, with an explanation of the roots from which they are derived. Our vulgar tongue is probably one of the most mixed and motley that the world contains. On the three great roots, Mahrata, Hindustani, and Guzeratee, have been ingrafted a absolute infinitude of stems, the most notable of which, as may naturally be supposed, is the Portuguese. But the terms thus derived have been so lengthened and shortened, so transformed by orthography, and

disguised by pronunciation, that it becomes almost next to impossible to recognise them; and yet with a little care and attention, they are capable of being tracked out after all. The very sound of the word Vellard indicates that it is not of Oriental origin—it is in reality the Portuguese Vellado, an embankment, the root of which again is the Latin Vallum. The English of course dropped the terminal O, and finding Vellad a very harsh-sounding term, clapped an R betwixt the A and D, and gave us Vellard. Again, the term Oart is exclusively applied to an enclosure containing cocoanut trees,—the only variety of palm that stands in need of watering and cultivation. It is simply the transformation of the Portuguese name for garden, and derived from the Latin Hortus. We mention these two, but dozens of others might be named; and a Vocabulary of the country is almost the only thing on which the first European invaders of India have left their mark. When Bombay was taken possession of, it was a settlement of fishermen and toddy-drawers, and the Portuguese were probably the first who introduced gardening or embanking. In the most civilized parts of the country, such things were commonly known by proper Oriental names, the Portuguese terminology being purely local.

Discoloration of the Sea.—We have been favored with the following account of a luminous appearance seen from on board the *Madras* on her recent trip to Aden, betwixt the twelfth and thirteenth parallels and fiftieth and sixty-fifth meridians:—

"The sea was running very high, and it was blowing a gale of wind when we went on deck at about midnight, and it appeared at first as if there was a dense fog, but after a few minutes it became apparent, that the horizon could be seen all round distinctly though faintly, as in some stage effect. The sea was of the faintest green color, almost like milk, and though so heavy a sea was running, yet even when looking over the side it appeared as smooth as glass —one could not even see the white spray of the waves as they toppled and broke. This appearance lasted for two nights and part of a third from about 10 o'clock till day break. Captain Down mentioned having seen it twice before near Ceylon."

These phenomena are of very frequent occurrence, and are chiefly to be met with in the region here described. A catalogue of them was published two years since in the *Nautical Magazine*, and they have frequently been discussed before the local learned Societies. So far as we have observed, they are by much the most frequent in the north-west monsoon. A luminous sea seen in February last from on board the *Cadiz*, formed subject of a communication from Mr. Frere, then a passenger, afterwards laid before the Bombay Asiatic Society. The appearances present themselves under a vast variety of forms. No satisfactory explanation has ever been given of them. When we talk of them as phosphorescences, or as produced by animalcules, we are merely striving to shield our ignorance under a name.

ERRATA.—Page 2, for *Nolumbiacæ* read *Nelumbiacæ*.

,, 11, Note, one line from bottom *for* Broach *read* Baroda.

,, 12, Note, 14 lines from bottom, omit full stop after four dozen and make them apply to phials.

,, 32—14 lines from bottom, for Gutta *Sernia* read Gutta Serena.

,, 48—18 lines from top for Rajpoor *read* Ranpoor.

,, 148, from second paragraph, beginning with "On recording should be given as a quotation on to bottom of page.

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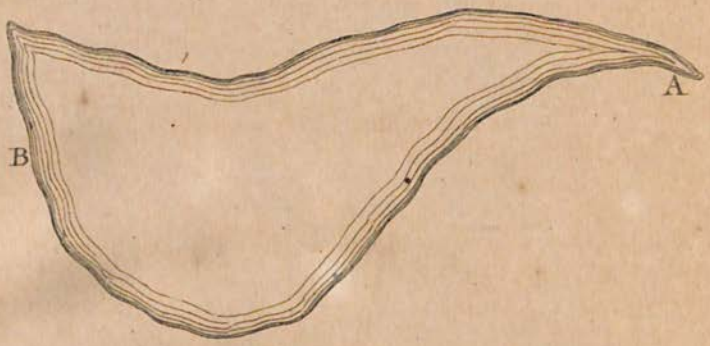
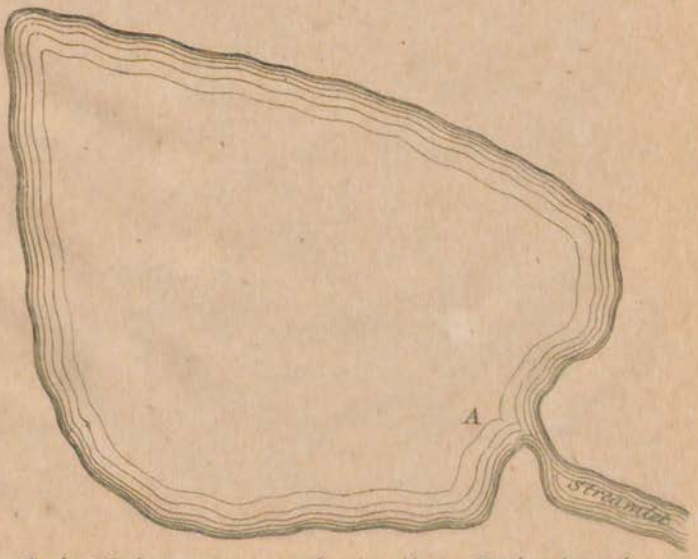
Dr Buist's drawing of the same on following plate.

REMARKABLE CONICAL HILLS.

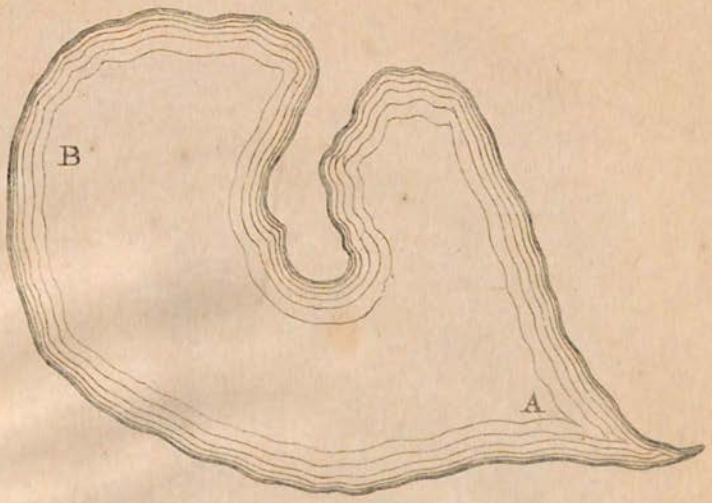
Said to be of granite, as seen from Wallee about six miles off. They are upon a low level, somewhat sandy plain, a fine stream of water beyond the tree



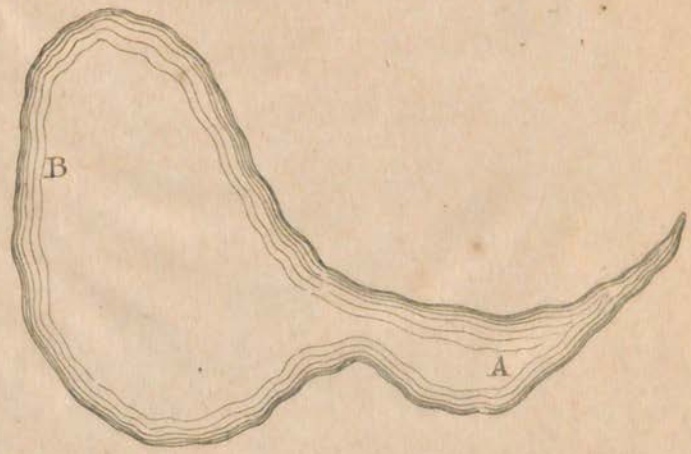
Tank Hagella, Kattiwar, 1200 yards circuit. A, Marsh Weeds; B, Embankment 10 feet high, 120 across, and 1000 long.



Lake Widwan, 2000 yards circuit, no Embankment A, Streamlet.



Lake Kurwa, near Wudwan, Kattiwar. A, Marsh, B, Embankment.



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